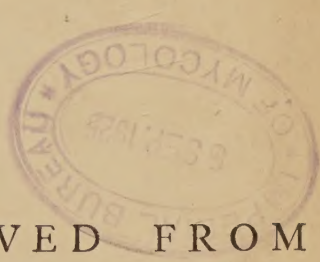


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EMPIRE COTTON GROWING CORPORATION

REPORTS RECEIVED FROM
EXPERIMENT STATIONS
FOR THE SEASONS 1923, 1924, AND 1925
(SOUTH AFRICA ONLY)



LONDON

1925

REPORTS RECEIVED FROM THE EXPERI-
MENT STATIONS FOR THE SEASONS 1923,
1924, AND 1925 (SOUTH AFRICA ONLY).

RECEIVED FROM THE EXTERIOR
STATION STATIONER THE STATIONER
FOR SOUTH AFRICA ONLY

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SOUTH AFRICA

THE BREEDING OF JASSID-RESISTANT COTTONS

BY

F. R. PARNELL

THE desirability of improving the varieties of cotton grown in the Union has been increasingly obvious to all concerned in the industry for several years, and it was partly for work in this direction that the help of the Empire Cotton Growing Corporation was solicited by the South African Government. Mr. Milligan, after his arrival in June, 1924, discussed the situation with officers of the Tobacco and Cotton Division, and it was decided that the breeding work already in progress at Rustenburg should be applied especially to the middle veld areas, and that the Corporation's Plant Breeder should work for the low veld cotton belt, which extends through the Eastern Transvaal into Zululand. It is with the latter area that this note is concerned.

Work was started at Barberton at the beginning of the 1924-25 season on a piece of land set apart by the prison authorities and on special plots very kindly grown by Messrs. Andrews and Spear on their own farms. The crop grown comprised the following:

1. A collection of the chief varieties under cultivation in the Union.
2. Several varieties imported from the United States of America and one from India.
3. Several strains of Improved Bancroft and Meade raised by officers of the Tobacco and Cotton Division.
4. About fifty single plant selections out of Zululand Hybrid from Messrs. A. P. Rouillard and Cross Estates, Ltd.

Thanks are due to a number of gentlemen who supplied the seed and helped to make the whole collection a good one.

The season is not yet finished, and quantitative results have not been obtained, but certain definite conclusions may be drawn from the experience gained up to date.

It was originally intended to work mainly on single plant selections, but also, if possible, to make mass selections in the two varieties most largely grown in the Union—viz., Zululand Hybrid and Improved Bancroft—in order to secure some immediate improvement. With both varieties, however, though the seed planted was the best obtainable, an examination of the crop at the beginning of the flowering period showed enormous variation, no dominant type existing, but good, bad, and indifferent plants being hopelessly mixed. The good plants covered a wide range of types, of which many appeared capable of giving sound economic strains if separated out and purified. In such a case it is impossible to determine the best type simply by inspection, since there is no such thing as an “ideal type” recognizable as such on sight. Mass selection of a number of separate types would have given very little bulk of seed of each, and the sole advantage of such selection would have been lacking. It was decided, therefore, to concentrate entirely on single plant selections. The appearance of jassid later in the season settled this point still more definitely. The whole breeding work is so bound up with this pest that a detailed consideration is necessary.

Jassid, *Chlorita fascialis*, often referred to as a leaf-hopper, is a very small winged bug which breeds on the underside of the leaf and sucks the sap. The effect produced on the leaf appears to be due more to some poisoning action than to a simple depletion of sap, but nothing definite is known on this point. In a bad attack the older leaves turn red and fall off; younger leaves curl up, turn reddish-brown, and gradually shrivel and dry up; the whole plant dries up considerably, but the growing points may remain alive, and be capable of shooting again if the jassid disappears.

As the plant matures it becomes increasingly susceptible to jassid attack. Speaking quite generally, the damage does not become serious until many of the earliest bolls are practically mature. If the early setting is good, a fair crop may thus be obtained in spite of jassid, though, of course, the loss it causes is still serious. Where, however, as is often the case, boll-worms have depleted the early crop of bolls and jassid prevents further setting, the position is most serious.

Jassid attacks have occurred over practically the whole of the low veld cotton belt, of which no part can be considered free. The intensity of the attack appears to depend largely on the season, more damage being caused in a wet season. At the best the pest is a serious one, which must be overcome if the cotton-growing industry is to be a success in the low veld.

It has been known for many years by workers in various countries that susceptibility to jassid and similar leaf-hoppers varies largely with the variety, and depends to a great extent on the degree of

hairiness of the leaf. Resistant types have been raised in India, and one of these, a selection from Cambodia, was sent by the Cotton Specialist, Madras, to Mr. Worrall, Tobacco and Cotton Expert, Barberton, who had written an article on the subject.

The effect of jassid on the different varieties and strains grown has been carefully noted throughout the season. Of the Union varieties, Watts's Long Staple is uniformly very susceptible. All the others are very mixed, and show great variation from plant to plant, though the proportion of plants showing any given degrees of susceptibility varies a great deal with the variety. Of the imported varieties, Cambodia, already mentioned, *shows complete immunity*; the jassid appears not to breed on it or damage it in the slightest. The varieties from the United States of America were all rather susceptible, and Webber 49 is the only one which offers any hope of possible improvement by selection. A number of strains of Improved Bancroft from the Rustenburg Experimental Station and two strains of Meade raised by Mr. Worrall were all too susceptible to be of any value, though one of the Meades might be useful for further selection.

The single plant selections from Zululand Hybrid proved extremely interesting. Some lots were more or less mixed, whereas others, especially such as were uniform in habit and general appearance, showed considerable uniformity as regards susceptibility to jassid. Of the uniform lots, many were distinctly susceptible, whereas others showed definite resistance of various degrees. The best lot, Z.1 of the table below, was uniformly good; all plants remained green throughout the attack, and are now, early May, still healthy. In many of the worst lots, every plant was brown by the end of March. There could be no better demonstration of the *inheritability of jassid resistance* and of the corresponding possibility of breeding resistant strains from the present mixed varieties.

The table given below shows an analysis of a number of varieties growing side by side. Every plant was roughly classified according to the degree of damage by jassid on April 11. The figures show the percentage of plants of the different degrees.

Variety.	Degree of Attack.				
	Nil.	Slight.	Moderate.	Rather Bad.	Bad.
Cambodia	100	—	—	—	—
Z.1	4	60	36	—	—
Uganda	3	8	27	32	30
Improved Bancroft	—	3	12	38	47
Zululand Hybrid	—	2	14	38	46
Griffin	—	—	2	27	71
Watts's Long Staple	—	—	—	—	100

The strain of Cambodia imported is very markedly resistant; the boll is large, and the lint of many of the plants is over $1\frac{1}{8}$ inches in staple. The habit, however, as it has grown this season, makes it of doubtful value as a field crop. It is very large, some of the plants being 8 or 9 feet high, and almost as much in diameter, and the stems are rather weak and delicate, making it subject to serious damage by wind. It may settle down to a more reasonable habit after a few seasons in this country. It is hoped to obtain other less rampant strains from India for trial next season.

The best single plant selection out of Zululand Hybrid, Z.1 of the above table, is suitable for immediate multiplication. It is markedly uniform, strong growing, rather lax and upright in habit, big balled, well over $1\frac{1}{8}$ inches in staple, and definitely resistant to jassid. The number of bolls is only fair for the size of plant, but the yield per plant will be uniformly good. A number of plants of this strain, many of which are selfed, have been selected for planting separately next season to purify and improve the strain still further if possible. The bulk seed should plant about 5 acres next season, and thus give enough seed to put out for multiplication if the strain proves good enough.

Single plant selections have been made from fields of Improved Bancroft and Zululand Hybrid specially grown for this purpose. Fortunately both fields were attacked by jassid, and it was thus possible to pick out resistant plants which showed up strikingly green amongst the general reddish-brown mass. It is practically certain, in view of the behaviour of the Zululand Hybrid selections this year, that many of these plants will give rise to markedly jassid-resistant strains. About 150 plants have been selected so far, all of good types carrying a large crop of bolls, and nearly all with lint of about $1\frac{1}{4}$ inches staple. On the whole, the Bancroft selections appear to be most promising, as they are generally of a better habit and carry a larger boll than those from Zululand Hybrid. A few selections from other varieties have also been made.

It may be noted that all the resistant plants are distinctly hairy, though all hairy plants are not necessarily highly resistant. The resistance appears to be due partly to some degree of immunity from attack, and partly to a constitutional power of tolerating the action of the pest. In fact, the resistant plants give the impression of being specially tough and hardy, and capable of withstanding all vicissitudes better than the average plant.

It will be seen that there is every reason for hoping that the jassid problem will be solved satisfactorily in the very near future, thus removing one of the most serious obstacles to the successful development of cotton growing in the low veld areas.

This note cannot be closed without some reference to the very

willing support and assistance given by the cotton growers of the district. Through the good offices of the De Kaap Agricultural Society, the Barberton Municipality has offered to the Department of Agriculture, practically free of rent, 100 acres of land for experimental and plant-breeding purposes. It is hoped that a proper cotton-breeding station will be opened on this land for next season. A sufficient area for next season's crop has already been cleared and ploughed free of charge by the Society, in order that the broken land should receive the late rains, and thereby become more fit for experimental work. The land is in a solid block, very level, and possessing a deep, uniform, good soil thoroughly suitable for experimental work. The situation of the De Kaap valley midway down the cotton belt, its easy accessibility by rail, the existence of a well-controlled ginnery and good organization for seed supply and distribution, the constant presence of jassid for testing strains, and the existence of large stores, from which sudden urgent requirements of the work may be obtained, are all factors which make Barberton a very happy choice for the new station.

An experiment was started in which the same set of varieties was planted side by side at Barberton, Malelane, and Candover. From the results so far seen, it would appear that a variety good in one of these areas would also do well in the others. If this holds good as a general rule, it will greatly simplify the work of producing strains suitable for the various parts of the low veld area.

BARBERTON,

May 5, 1925.

TANGANYIKA TERRITORY

REPORT ON EXPERIMENTAL WORK AT MPANGANYA, 1924

BY

R. C. WOOD, M.A., DIP.AG. (CANTAB.)

(This is an abridgement of the original reports sent in by Mr. Wood and Mr. McEwen, and should be read in continuation of the Report for the Seasons 1922 and 1923, *Empire Cotton Growing Review*, Vol. II., p. 14.)

RAINFALL AND SEASON

As will be seen from the Rainfall Table attached, the rainfall was, again, most deficient, and though the latter part of the season was favourable, the short sowing rains and their abrupt termination caused considerable anxiety.

SELECTION WORK

(a) 1922 *Selections*.—Of the five strains selected in 1923* and sent home for spinning tests, only two (**J** and **M**) were ultimately retained. All were sown, as the report on their spinning qualities was not received before the season started; the other three were discarded later on, when the report arrived. **D** was actually better than **J** from the spinners' point of view, but **J** was a noticeably stout, healthy plant, and it was decided to keep it in preference. Two sets of plots were sown for comparison of yield, and observations were also made on the time and rate of growth and ripening, the proportion of clean cotton as indicating resistance to insect attack, the ability to withstand drought, and the general hardiness.

The remainder of the seed, over and above that used for sowing these comparative plots, was sown widely spaced in multiplication plots, removed as far as possible from each other and from other cottons. **M** did well, and over 1,000 lbs. of seed cotton of this strain, yielding nearly 700 lbs. of seed, will be available for next season's planting. This will be the first seed to go out into general cultivation, it is hoped, in the season 1926-27.

(b) 1923 *Selections*.—A certain amount of selection was carried out of likely plants found in plots of plants picked in the previous

* See Vol. II., p. 18.

year, and seven plants were eventually chosen for further trial. Besides these, three new selections, named **P**, **Q**, and **R**, were chosen. These were all sown in adjacent strips as in the previous year, except that they were spaced $1\frac{1}{2}$ yards instead of 1 yard to allow the stitching boys to pass freely between the plants. With them were also sown two other varieties—viz., “Serere,” obtained by the courtesy of the Department of Agriculture, Uganda; it is the selected strain which is being issued from the Serere Agricultural Station; and “Salsbury,” an American cotton, which had been imported to serve as a *standard* by which the local selections could be tested as regards their uniformity and consistency.

One strain, **R**, did not germinate at all: **C 1** and **H 1** were cleared out at an early stage, and this left the eight strains given in Table IV. Careful records were kept of thirteen plants in each of these, on lines similar to those adopted in the previous year, and it is satisfactory to note that not only is this record very complete, but it shows that re-selection has proved beneficial and has reduced the co-efficients of variation in all cases where the character was capable of mathematical expression (Table IV.). The actual length of lint averages rather less than in the previous year—25.4 mm. to 26.3 mm.—but it is considered that the greater uniformity more than compensates for this.

Figures were also obtained for the percentage of flowers that set seed, and these show marked differences, though no attempt is made to assign reasons for this. The quality of the flowering curve has also been taken into consideration, the ideal one showing a sharp rise up to a peak and an equally abrupt fall. **K 1** had probably the poorest curve: to serve as a comparison the curve of **D 1** is shown (Fig. I.). It will be noticed that **K 1**, in spite of a poor flowering curve, has a better bolling curve than **D 1**, with a higher percentage of setting (Table IV.), 46 to 35 per cent. The ideal plant would combine the heavy flowering characteristic of **D 1** with the early termination of bolling shown by **K 1**, without at the same time sacrificing anything in the way of yield. The curves are of interest, therefore, in showing what kind of a standard might be reached by careful and unremitting search and examination.

Attention has been drawn to the question of *hairiness* by Mr. Sampson in Nyasaland, and observations of this character have been made during this and the preceding season. No indication has at present been found that any of the selections now being grown here are of a particularly hairy character. Slight differences have been recorded, but they are insignificant beside the hairiness of Salsbury, which was, moreover, very consistent for this character.

As for *pollen colour*, practically all the selections have yellow pollen, as compared to the nearly white borne by Salsbury. An odd

white-pollened plant occurs in **J 1** and in **P**, while in **K 1** all the plants possess white pollen, except for one yellow and one so pale as to be scarcely distinguishable. Last year this selection threw one yellow pollen in the ten plants recorded, but the plant selected was one bearing white pollen. Most of the American varieties introduced and grown last year had white pollen and were pure in this respect, so that evidently the stock on which we are working has departed considerably from the original American stock.

The *seed* shows a great improvement in uniformity over that of last year. **J 1**, for instance, produced a very nice sample of absolutely uniform seed; one plant had slightly less fuzz than the others, but this was only just recognizable. It was more uniform, in fact, than Salsbury, the standard. The *size of the boll* records the diameter of three typical bolls from each plant. It is not a measurement of very much value, and this year at Morogoro it was discontinued in favour of the ratio, breadth over length. It is doubtful, however, if much can be made of either the size or the shape of the boll, without handling larger numbers than were at the time convenient.

The measurement of the *style* also seems to be a character which, for the purpose of testing the purity of a strain, possesses little value. It is suggested that the recording of this character might be discontinued.

(c) 1924 *Selections*.—The following are the selections made in the current year. It may be noted that the letters which were originally used to distinguish the selections have given place to numbers preceded by the letters Mp. or Mo., according as to whether the selections were made at Mpanganya or Morogoro in accordance with the following scheme.

A = 1	F = 6	M = 12
B = 2	H = 8	N = 13
C = 3	J = 9	O = 14
D = 4	K = 10	P = 15
E = 5	L = 11	Q = 16

A single number denotes a selection made *de novo* in local or other unselected cotton. A re-selection receives a double number, and all numbers run consecutively, in continuation of the previous selection of the same sort. The selections made this year thus receive the following numbers: (1) **Mp. 8/1** is the first re-selection made in selected strain **H** (now called **Mp. 8**); (2) **Mp. 9/2** is the second re-selection made in strain **J** (now **Mp. 9**), the first re-selection having been made in the previous year (see **J 1** above); (3) **Mp. 13/3** is the third re-selection in strain **N** (now **Mp. 13**), **Mp. 13/1** and **Mp. 13/2** having been grown and discarded in the previous year; (4) **Mp. 18** is a new selection from the station unselected crop; as also is (5) **Mp. 19**. There is not much to report on these at present: their characteristics will be found in Table III.

GENERAL EXPERIMENTAL WORK

This deals with the following experiments conducted at the station during the season:

1. Time of planting, "natural."
2. Time of planting, "artificial."
3. Deep cultivation experiment.
4. Spacing experiment.
5. Cage experiment.

The two "time of planting" experiments are conducted on similar lines, and continue the experiments reported on in the previous year's report (*loc. cit.*, para. 18 *seq.*). Extra precautions were taken to secure more uniform land for the experiment, and the plots were arranged in duplicate. In the "natural" experiment the seed was put into the ground on the regular day, whether there was any prospect of immediate germination or not; in the "artificial" series regular germination was ensured by the use of water. This was discontinued as soon as germination was complete, and thereafter the plots received exactly the same treatment as the "natural." The table below shows how the plots germinated:

<i>Date of Sowing.</i>	<i>Date of Germination</i> <i>("Natural").</i>	<i>Date of Germination</i> <i>("Artificial").</i>
March 24	March 29	March 28
April 7	April 11	April 11
April 21	April 28 (partial)	April 29
May 5	May 14 (partial)	May 9
May 19	June 14	May 23
June 2	June 14	June 6

The results are very definite in two directions. There is a steady diminution in yield from the earliest to the latest planted plot, and, though less definite, there is evident a steady improvement in the quality of the lint produced up to about the end of April, after which it seems to deteriorate slightly. The figures for proportion of dirty cotton given in Table V. are the basis for this statement. If these are considered reliable, there is a certain risk in picking the very early deliveries of cotton at the ginneries to be used as seed for the coming year. Such first pickings are not generally considered to be of the best quality.

The experiment is thus extremely definite, but it must be remembered that the season was an exceptional one. Notes made during the crop's progress show that there were good, even excellent, patches in some of the late-sown crops, but that the proportion of plants failing to establish themselves before the upper layers of the

soil dried out increased with the later sowings. It was, in fact, entirely, or almost entirely, a question of moisture in the soil. A great deal of good cotton may, in normal years, be harvested from fields put in as late as the later sowings of this experiment, but only on lands which have been flooded and which are exposed as the water recedes. Practically the point is not of importance at present, but if irrigation were ever to become a reality in the Rufiji valley, it might be important to be able to delay sowings to fit the crop in with others.

As compared with last year, it may be noted that the earliest plot this year was probably not early enough for the purposes of the experiment, as it was the best. It would be better to work more on the earlier sowings than on the later sowings, and to ascertain the earliest date at which it pays to plant cotton, for it may be taken as fairly certain that, at Mpanganya, in anything like a normal season, no sowing after the middle of May is going to produce a full crop. It is recommended that the experiment be modified next year in this direction to test sowings in February or early March; otherwise the layout appears quite satisfactory, and need not be changed; on uniform land it is capable of giving good results.

Deep Cultivation Experiment.—The result of this experiment has been surprising, inasmuch as no difference has been shown between plots which were deeply and thoroughly cultivated and plots which received only the shallow cultivation typical of the native (Table VI.). The object of the experiment was to get an idea of what the value of deep cultivation was likely to be in terms of crop, as the question of the mechanical tillage of these soils was raised by Major Hastings Horne in his report; indeed, in view of the flat nature of the land and the impossibility of using cattle, this at once suggests itself. It is no use working out the cost of ploughing when there are no data to show what kind of an increased crop can be expected from land so ploughed. In the circumstances in which this experiment was carried out, the result would be little or nothing; the land was distinctly sandy in texture, and possibly on finer soil a difference would appear in favour of the deep cultivation. The experiment is worth repeating with the plots rather wider.

Spacing Experiment.—A very tentative trial was made in 1923 to get some information on the subject of the best distance at which to plant cotton, and as a result of this and experience elsewhere, a careful trial was made this year to compare eight different spacings, four planted with rows 3 feet apart and four with rows $2\frac{1}{2}$ feet apart. The spacings in these were 6, 12, 18, and 24 inches respectively. The full results are tabulated in Table VII., and shown diagrammatically in Fig. II., which show the yields both theoretical and actual.

It is not possible to say definitely what is the best spacing to adopt for the crop in these conditions. The yields are set out below, according to the actual spacing, as calculated from the number of plants in the plots.

<i>Square Inches per Plant.</i>	<i>Actual Mean Yield.</i>	<i>Yield, Corrected as Below.</i>	<i>Percentage of Stained Cotton.</i>
202	43	38	39
242	46	36	34
350	46	46	29
424	56	56	37
535	50	48	37
617	58	60	32
692	53	60	32
820	50	46	36

The second column gives the actual mean yield of the three plots with the same spacing (see Table VII.); in the third column an endeavour is made to get a more trustworthy figure by picking out (usually) the two plots of which the yields are approximately equal, or taking all three where divergence is small. It is not claimed that the figures are very reliable, but they emphasize what seem to be the facts of the case, which are that the highest yields are obtained from the moderate spacings, and that too narrow or too wide spacing alike depresses the yield, as will be seen from Fig. II., which shows the yield plotted to correspond with the average number of square inches occupied by a plant. The explanation would seem to be that too close spacing leads to suppression of the lower branches and a general weakening of the plant: too wide spacing leads to over-production of secondary branches, and a consequent delay and reduction in the yield. There was no indication of any difference in the quality of the cotton from the different spacings: the proportion of stained and dirty cotton in each plot is given in the last column of the table above.

Cage Experiment.—This is a repetition of an experiment carried out last year, and it is satisfactory to be able to report that the results which were considered extremely suggestive last year have been completely confirmed from this year's work. Briefly, the experiment is to estimate the action of various cotton stainers and bugs upon cotton, by putting up two wired-in cages, into one of which these insects are deliberately introduced, while the other, as a control, is kept entirely free from all such insects. Last year sixteen bolls were collected from the control cage, *not one of which was stained*, while of thirteen bolls collected in the infected cage, ten were stained and one was unhealthy. The results this year have been exactly the same: twenty-nine bolls were picked in the control

cage, and *all were clean and healthy* ; in the infected cage nineteen bolls were picked, of which sixteen were stained and only three were healthy. It may be stated accordingly that insects like the Red Cotton Bug (*Dysdercus*) and the Dusky Bug (*Oxycarcænus*) are responsible for much of the stained cotton, either directly or, as has been indicated elsewhere, by introducing fungi, such as *Eremothecium*.

TABLE I.—RAINFALL (MPANGANYA).

	1911.	1912.	1913.	1923.	1924.
	Mm.	Mm.	Mm.	Mm.	Mm.
January	41	161	134	—	*
February	84	226	104	—	*
March	78	187	303	51	116†
April	234	139	223	159	45
May	25	36	14	18	25
June	—	11	15	3	45
July	5	7	2	2	—
August	—	4	17	4	1
September	1	1	—	1	10
October	8	5	5	7	—
November	64	94	130	52	—
December	120	24	39	*	—
Total millimetres ..	660	895	990	—	—
Total inches	26	35	39	—	—

* No records were taken from the time Mr. McEwen left till he returned.

† From the 16th only.

TABLE II.—YIELD OF STRAINS GROWN AT MPANGANYA,
SEASON 1924.

(OUNCES PER LINE.)

<i>Line Numbers.</i>	<i>D (4).</i>	<i>H (8).</i>	<i>J (9).</i>	<i>M (12).</i>	<i>N (13).</i>	<i>Salisbury.</i>
1	25	44	36	25	30	36
2	80	44	17	50	30	15
3	0	29	22	35	17	25
4	22	20	40	48	42	28
5	80	61	74	64	91	83
6	100	42	35	29	61	97
7	73	60	59	35	76	104
8	0	59	62	33	31	63
9	133	92	112	80	103	73
10	83	82	90	55	122	114
11	112	58	78	47	37	50
12	75	48	69	71	64	74
Mean	66	53	58	48	59	63
P.E.	±29	±13	±19	±11	±23	±22

TABLE IV.—1923 SELECTIONS: MPANGANYA, 1924 SEASON.

SYNOPSIS OF BEHAVIOUR OF EIGHT INDIVIDUAL PLANTS.

	Weight of 100 Seeds.		Lint Index.		Lint Kappas.		Length of Lint.		Mean C.V.	Per Cent. Setting.	Quality of Flower- ing Curve.
	M.	V.	M.	V.	M.	V.	M.	V.			
D 1 (Mp. 4/1)	10.59	8.3	4.25	8.1	28.6	1.8	28.9	2.3	5.15	35	18
D 2 (Mp. 4/2)	11.36	6.8	4.48	4.3	28.3	4.3	26.5	2.6	4.49	39	9
J 1 (Mp. 9/1)	9.75	7.9	4.19	12.1	29.9	5.5	26.4	2.2	6.92	39	18
K 1 (Mp. 10/1)	10.33	7.4	4.16	7.5	28.7	3.5	25.5	3.6	5.51	46	4
N 2 (Mp. 13/2)	9.83	9.9	4.31	7.6	30.5	6.1	25.5	2.2	6.45	54	7
P (Mp. 15)	8.84	10.8	3.98	9.4	31.1	4.4	21.7	4.6	7.30	45	13
Q (Mp. 16)	10.58	8.5	4.28	9.2	28.8	5.6	26.6	4.6	6.97	46	16
Serere	10.90	7.9	4.76	17.7	30.3	10.1	26.3	3.6	9.8	—	—
Mean of above	10.27	8.5	4.3	8.3	29.5	4.4	25.4	3.15	—	—	—
Mean previous year	9.6	9.0	4.1	11.1	30.2	6.4	26.3	5.81	—	—	—
Salsbury	10.37	6.1	5.88	6.5	36.2	2.9	23.3	3.8	4.83	46	—

TABLE V.—TIME OF PLANTING EXPERIMENTS.

TOTAL YIELD OF COTTON IN PLOTS.

"NATURAL."					
March 24.	April 7.	April 21.	May 5.	May 19.	June 2.
lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.
19 4	17 12	8 2	8 6	1 8	— 2
21 0	21 0	8 4	7 8	3 8	— 6
44 2	25 12	10 0	6 14	2 12	— 8
20 14	21 14	16 6	9 12	2 6	— 4
105 4	86 6	42 12	32 8	10 2	1 4
"ARTIFICIAL."					
44 0	35 12	24 14	17 4	12 4	2 10
51 4	43 12	37 0	24 4	10 14	1 10
44 10	39 10	26 12	18 0	7 12	— 14
37 2	26 4	16 6	13 2	4 10	1 12
177 0	145 6	105 0	72 10	35 8	6 14
PROPORTION OF DIRTY COTTON PER CENT.					
"NATURAL."					
42	44	26	21	24	—
"ARTIFICIAL."					
26	18	12	13	15	—
ACTUAL YIELD OF CLEAN COTTON.					
"NATURAL."					
60	50	39	34	8	—
"ARTIFICIAL."					
130	119	93	63	30	—

TABLE VI.—DEEP CULTIVATION EXPERIMENT.

Deep.		Shallow.	
Number.	Yield.	Number.	Yield.
A 1	lbs. oz. 13 6	B 1	lbs. oz. 10 4
2	10 10	2	11 8
3	11 2	3	11 6
4	12 0	4	10 8
5	11 4	5	12 14
Mean	11 10	Mean	11 4

TABLE VII.—SPACING EXPERIMENT.

Plot Number.	Spacing.	Square Inches.	Number of Plants.		Individual Plots.	Actual Spacing.	Yield in Ounces.	Mean.
			Theoretical.	Actual.				
A 1 C 1 E 1	36 × 6	216	300	267	$\begin{Bmatrix} 272 \\ 260 \\ 269 \end{Bmatrix}$	242	$\begin{Bmatrix} 36 \\ 66 \\ 36 \end{Bmatrix}$	46
A 2 C 2 E 2	36 × 12	432	150	153	$\begin{Bmatrix} 145 \\ 154 \\ 160 \end{Bmatrix}$	424	$\begin{Bmatrix} 76 \\ 56 \\ 36 \end{Bmatrix}$	56
A 3 C 3 E 3	36 × 18	648	100	105	$\begin{Bmatrix} 99 \\ 101 \\ 115 \end{Bmatrix}$	617	$\begin{Bmatrix} 60 \\ 54 \\ 60 \end{Bmatrix}$	58
A 4 C 4 E 4	36 × 24	864	75	79	$\begin{Bmatrix} 82 \\ 76 \\ 78 \end{Bmatrix}$	820	$\begin{Bmatrix} 60 \\ 44 \\ 46 \end{Bmatrix}$	50
B 1 D 1 H 1	30 × 6	180	300	266	$\begin{Bmatrix} 273 \\ 251 \\ 276 \end{Bmatrix}$	202	$\begin{Bmatrix} 52 \\ 38 \\ 38 \end{Bmatrix}$	43
B 2 D 2 H 2	30 × 12	360	150	153	$\begin{Bmatrix} 144 \\ 144 \\ 172 \end{Bmatrix}$	350	$\begin{Bmatrix} 44 \\ 40 \\ 54 \end{Bmatrix}$	46
B 3 D 3 H 3	30 × 18	540	100	101	$\begin{Bmatrix} 104 \\ 96 \\ 102 \end{Bmatrix}$	535	$\begin{Bmatrix} 54 \\ 48 \\ 48 \end{Bmatrix}$	50
B 4 D 4 H 4	30 × 24	720	75	78	$\begin{Bmatrix} 80 \\ 75 \\ 78 \end{Bmatrix}$	692	$\begin{Bmatrix} 62 \\ 38 \\ 60 \end{Bmatrix}$	53

APPENDIX I

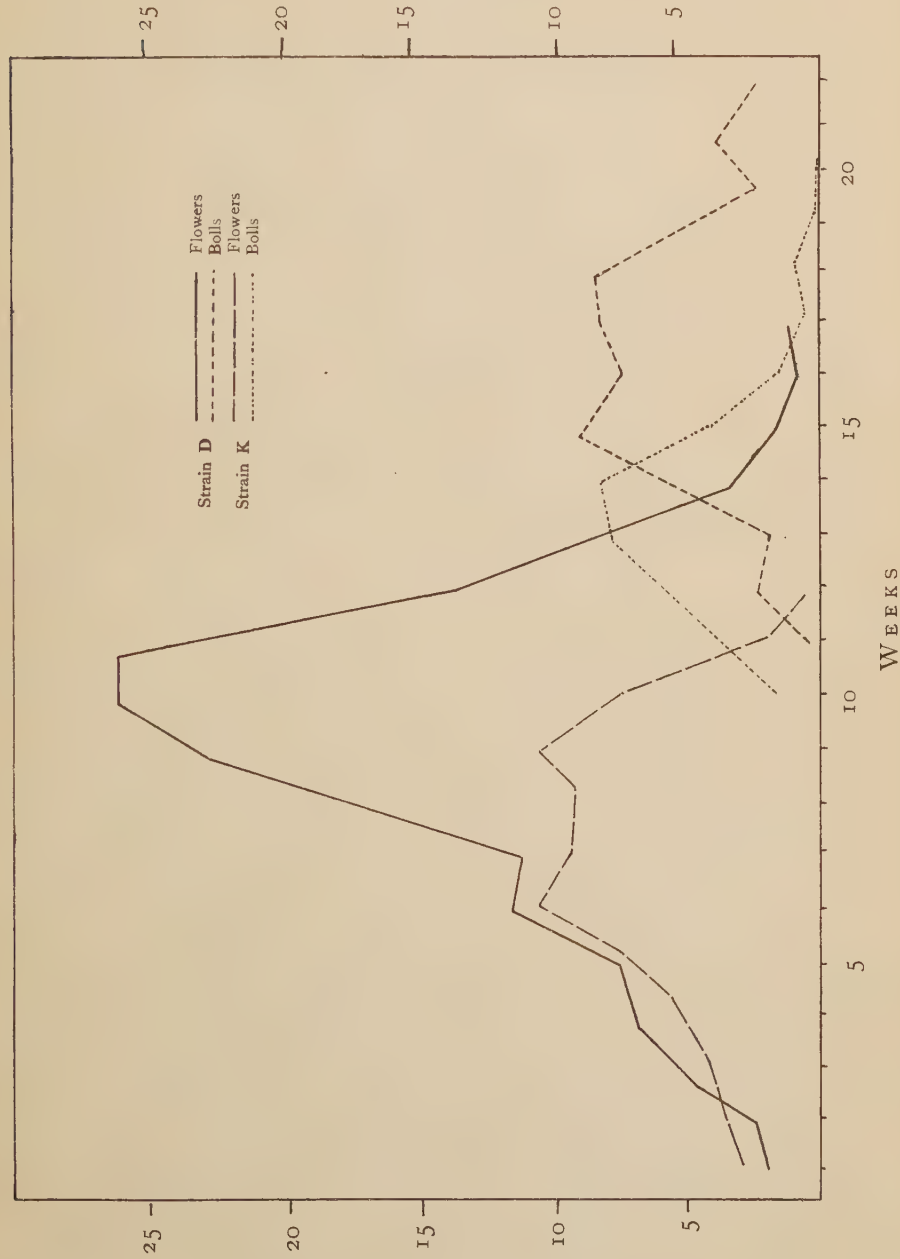
Samples of lint were sent for spinning tests, conducted by the courtesy of the Fine Cotton Spinners' and Doublers' Association, and for brokers' valuations, of the two 1922 selections, **Mp. 9** and **Mp. 12**, to compare with those made in the previous year; and of those of the 1923 selections which appeared worthy of continuation. The results are given below:

SPINNING TEST: 1922 SELECTIONS.

	1923.			1924.		
	Loss.	Counts.	Strength.	Loss.	Counts.	Strength.
Mp. 9 (J)	8.7	60's	31.3	12.3	57's	37.8
Mp. 12 (M)	6.2	60's	34.2	11.6	57's	36.3

FIGURE I.

NUMBER OF FLOWERS AND BOLLS PER PLANT
PER WEEK



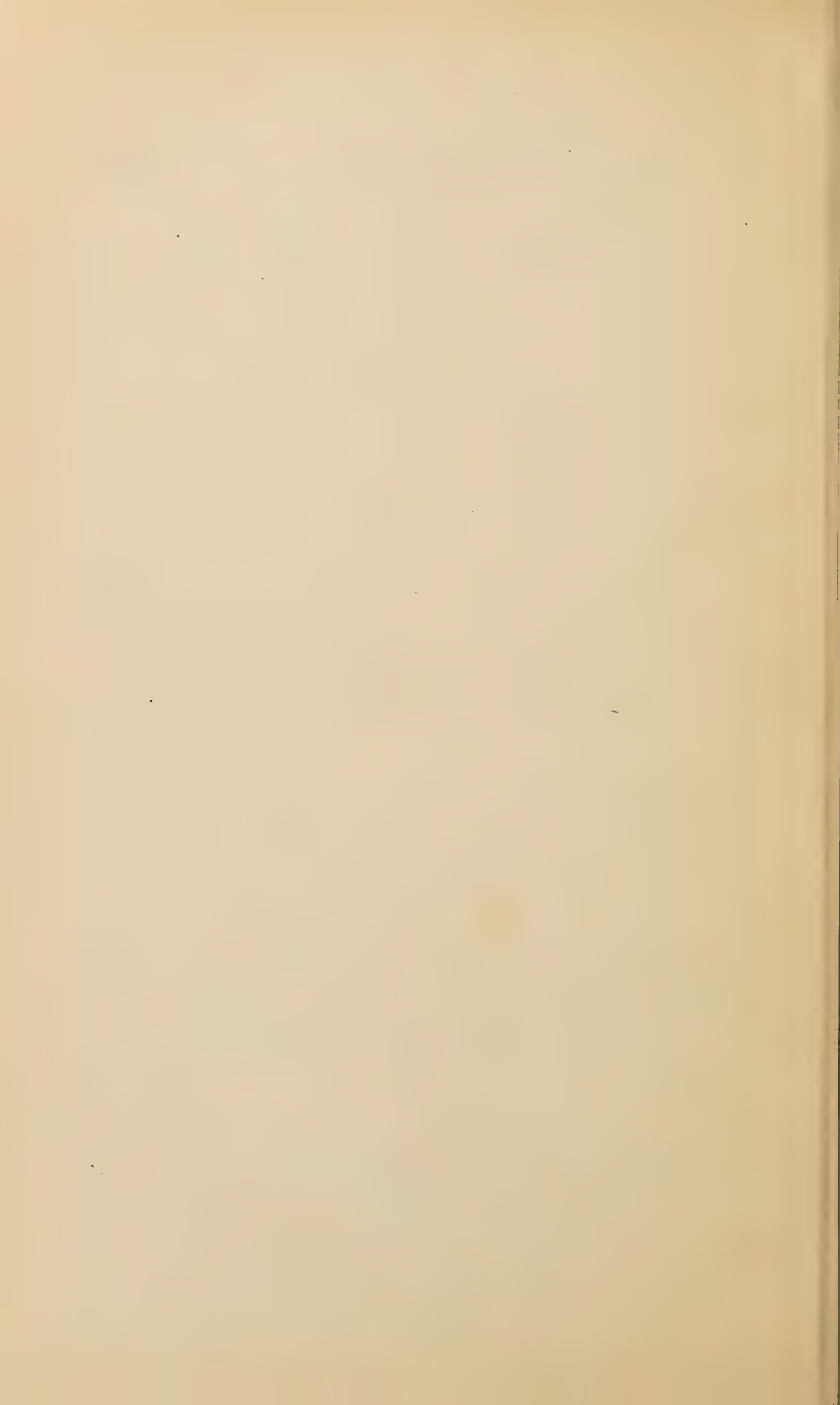
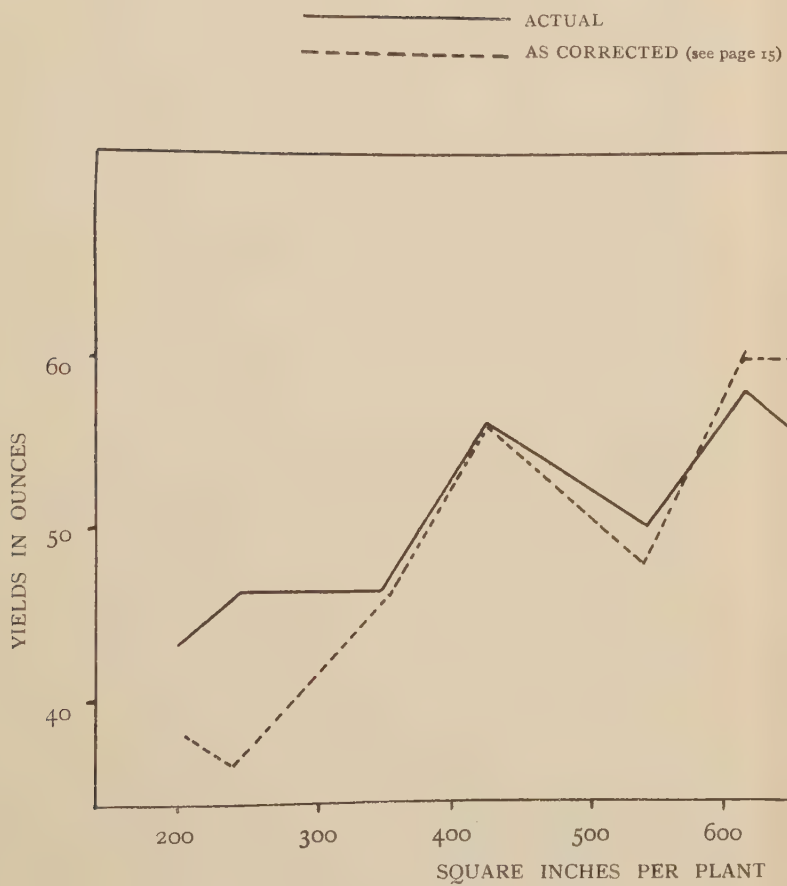


FIGURE II.

SPACING EXPERIMENT

YIELDS AT EACH SPACING



SPINNING TEST: 1923 SELECTIONS.

<i>Number.</i>	<i>Scutcher Loss.</i>	<i>Card Loss.</i>	<i>Counts.</i>	<i>Strength.</i>	<i>Strength × Counts.</i>
Mp. 4/1	4·7	10·7	All at 57's	35·5	2,023
Mp. 4/2	4·7	9·7		39·1	2,228
Mp. 9/1	5·0	9·7		35·9	2,046
Mp. 10/1	4·4	11·1		32·5	1,852
Mp. 16	3·9	10·3		33·5	1,909

Observations.—**Mp. 9** has come out better than **Mp. 12** this year, but, in view of the fact that there is a much larger quantity of seed of the latter, it has been decided to concentrate on **Mp. 12** for the present. Of the 1923 selections, **Mp. 16**, a new selection, has been rejected. Of the re-selections, **Mp. 10/1**, **9/1**, and **4/1** will not be continued. Fresh selections might be made in **Mp. 9** during the current year.

REPORT ON SELECTION AND EXPERIMENTAL WORK AT MOROGORO, SEASONS 1923 AND 1924

Work in 1923 was confined to the selection of a number of plants from different parts of the district where plots had been sown by the Agricultural Department. These were collected to the number of 134, and by careful examination and comparison were reduced to ten, described in Table I.

These 1923 selections were sown out in single lines, spaced 1 yard each way, on a small plot of land near Morogoro which was rented for the purpose. Sowing was intentionally done rather late in the season, but, though a fair plant was obtained, the land proved extremely uneven and in portions of it the plants hardly grew at all, in spite of careful treatment. Besides the above strains, which each occupied from 2 to 8 lines of 100 plants, four plots of "locals," of 3 lines each, were scattered across the field, while, as at Mpanganya (*q.v.*), plots of Serere and Salsbury were also sown. Numbers 1, 2, 4, and 8 were discarded early; they were not thriving.

The usual examination of individual plants in each selection was done, but, owing to the great irregularity with which the plants grew, reliable comparisons could not be made. It was decided to persevere with **Nos. Mo. 5**, **Mo. 6**, and **Mo. 9** (Table II.). They reach a fair standard of lint, and, though the weight of seed is not very good, they tend to show the desirable characteristic of a quick, early, and complete flush of flowers, leading to a clean and early crop of cotton.

Fig. I. shows the flower production of each of these three strains compared with the mean of the whole plot.

The "locals" plots were interesting as showing the poor and irregular quality of much of the seed now being used. One plant possessed a lint length of only 20.2 mm., and the average for all was only 23 mm. The weight of 100 seeds varied from 7.60 grammes, the lowest of any, to 10.57, the highest recorded.

Very small quantities of lint of **Nos. Mo. 5, Mo. 6, and Mo. 9** were available for spinning trials conducted by the courtesy of the Fine Cotton Spinners' and Doublers' Association; and they were also subjected to a brokers' valuation. The results show the cotton to be of a poor quality, as might have been expected from the fact that growth was so poor that every bit of cotton, stained or otherwise, had to be used to make up the sample. **Mo. 9** was reported the best, and it is worth noting that two re-selections were made from this strain during the season. The full reports are as follows:

SPINNING TEST.

<i>Number.</i>	<i>Scutcher Loss.</i>	<i>Card Loss.</i>	<i>Counts.</i>	<i>Strength.</i>	<i>Count × Strength.</i>
Mo. 5	5.9	14.6	57's	20.5	1,164
Mo. 6	7.7	21.0	57's	21.5	1,235
Mo. 9	5.9	19.2	57's	26.3	1,492

BROKERS' REPORT, BASED ON AMERICAN FUTURES AT 13.00D.

<i>Number.</i>	<i>Value.</i>	<i>Classification, etc.</i>
Mo. 5	14.00d.	Rather high colour, staple about $1\frac{1}{8}$ inches, soft and wasty.
Mo. 6	14.00d.	Rather high colour, staple about $1\frac{1}{8}$ inches, soft and wasty.
Mo. 9	14.00d.	Rather high colour, staple about $1\frac{1}{8}$ inches, soft and wasty.

1924 SELECTIONS

There was not much opportunity for carrying out any wide scheme of further selection in this year. A few plants, some in the plot, and others in the district which were noticed in the course of travel, were collected and examined, and of these six only appeared deserving of further trial. They are as follows: Two new selections, **Mo. 11** and **Mo. 12**; one re-selection from **No. 5** and two from **No. 9**, which are therefore numbered **Mo. 5/1** and **Mo. 9/1** and **Mo. 9/2**; and one selection from Serere, which, on the supposition that Serere is a selected strain, has been called **Mo. S1**.

GENERAL EXPERIMENTAL WORK

The regular records kept during the growth of the plant were a weekly record of the height of (originally) ten marked plants in each unit strain; a weekly record of the branching, and a daily record of the flowering and bolling.

(a) *Height*.—The average weekly increase in height varied from 2 inches early in the season to less than $\frac{1}{4}$ inch later on, resulting in a plant from 20 to 32 inches in height. Growth stopped almost entirely in September, but started again and continued up to the time when recording ceased.

No. 10 was the tallest strain, being more than 5 inches taller than any other. As will be seen from Fig. II., this is due to prolonged growth late in the season. **No. 9** was in the next plot, and is a fair comparison.

(b) *Branching*.—The numbers of fruiting and vegetative branches for each plant were recorded each week; the results at the close of the first period of growth are as follows:

TABLE III.

<i>Number.</i>	<i>Fruiting Branches per Tree.</i>	<i>Vegetative Branches per Tree.</i>	<i>Proportion of Vegetative Branches to 100 Fruiting Branches.</i>
3	12.2	1.6	13.1
5	14.1	0.5	3.5
6	12.6	1.2	9.5
7	13.9	1.5	10.8
8	13.7	0.7	5.1
9	14.4	1.0	6.9
10	17.1	0.8	4.6
Locals	13.9	1.8	12.9
Serere	17.0	0.8	4.7

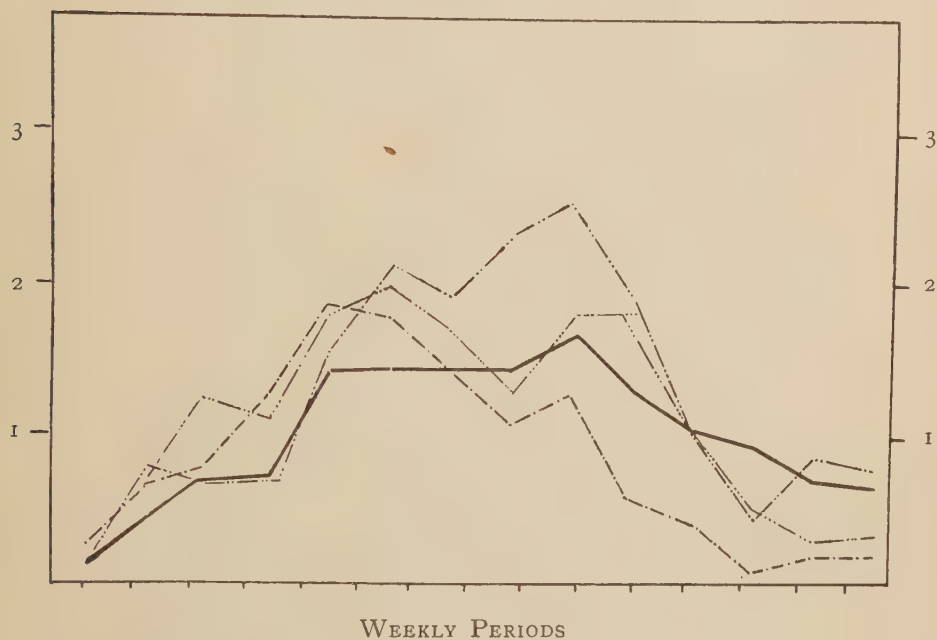
The conclusion can fairly be drawn from the above figures that the production of a low proportion of vegetative branches is a definite characteristic, and that selection can be made, if desired, with this object. Not, naturally, to the exclusion of everything else, for **No. 10**, for instance, is good in this respect, though really a poor and late strain.

(c) *Flowering*.—Allusion has already been made to the flower production of **Nos. 5, 6, and 9**. Fig. III. shows **No. 9** compared with **Nos. 3 and 10**, two strains poor in this respect, and attention may be given to the irregular and delayed curve shown by them.

A point of importance in connexion with this question of early maturity is the date which is fixed every year for the complete uprooting and burning of all cotton in the field. If this date is

FIGURE I.

WEEKLY PRODUCTION OF FLOWERS PER PLANT



— Whole plot (82 plants)
 - - - No. 5
 - - - No. 6
 - - - No. 9

FIGURE II.

WEEKLY RATE OF GROWTH OF TWO STRAINS AND THE AVERAGE OF ALL PLOTS

———— AVERAGE
----- STRAIN No. 9
- - - - - STRAIN No. 10

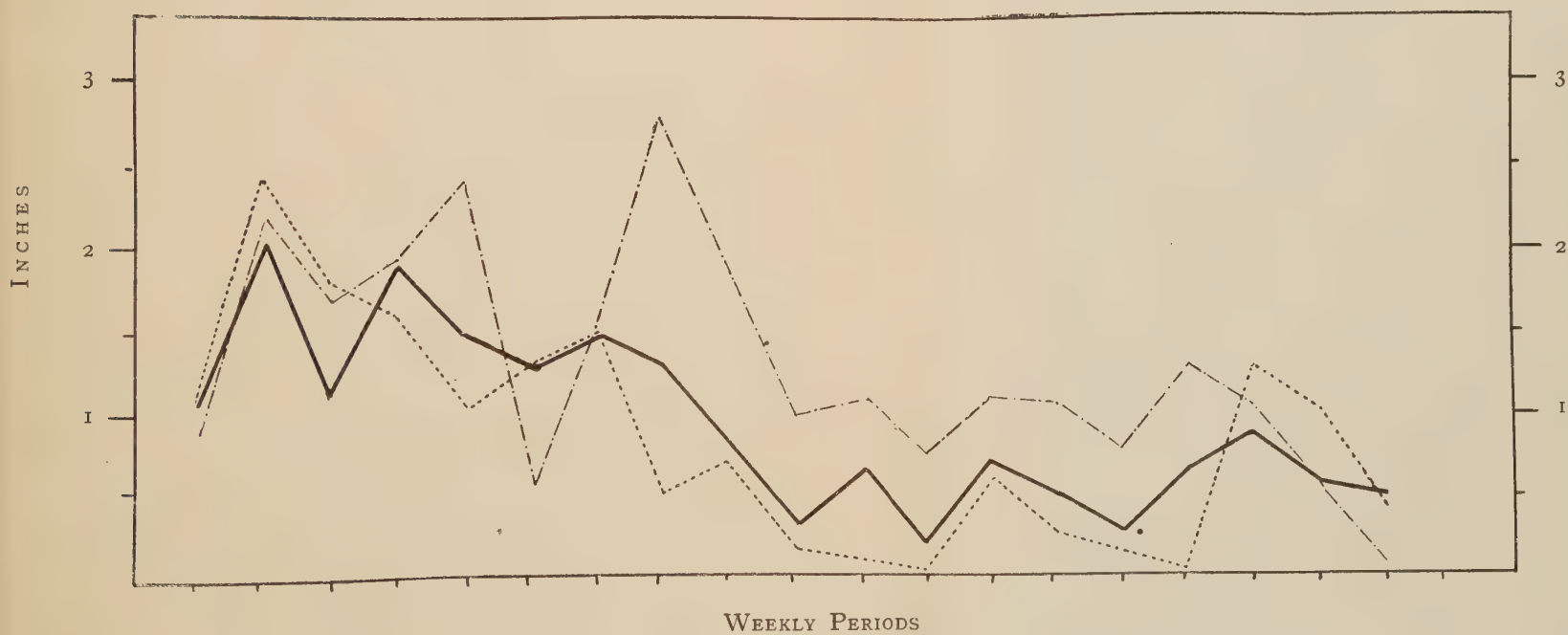
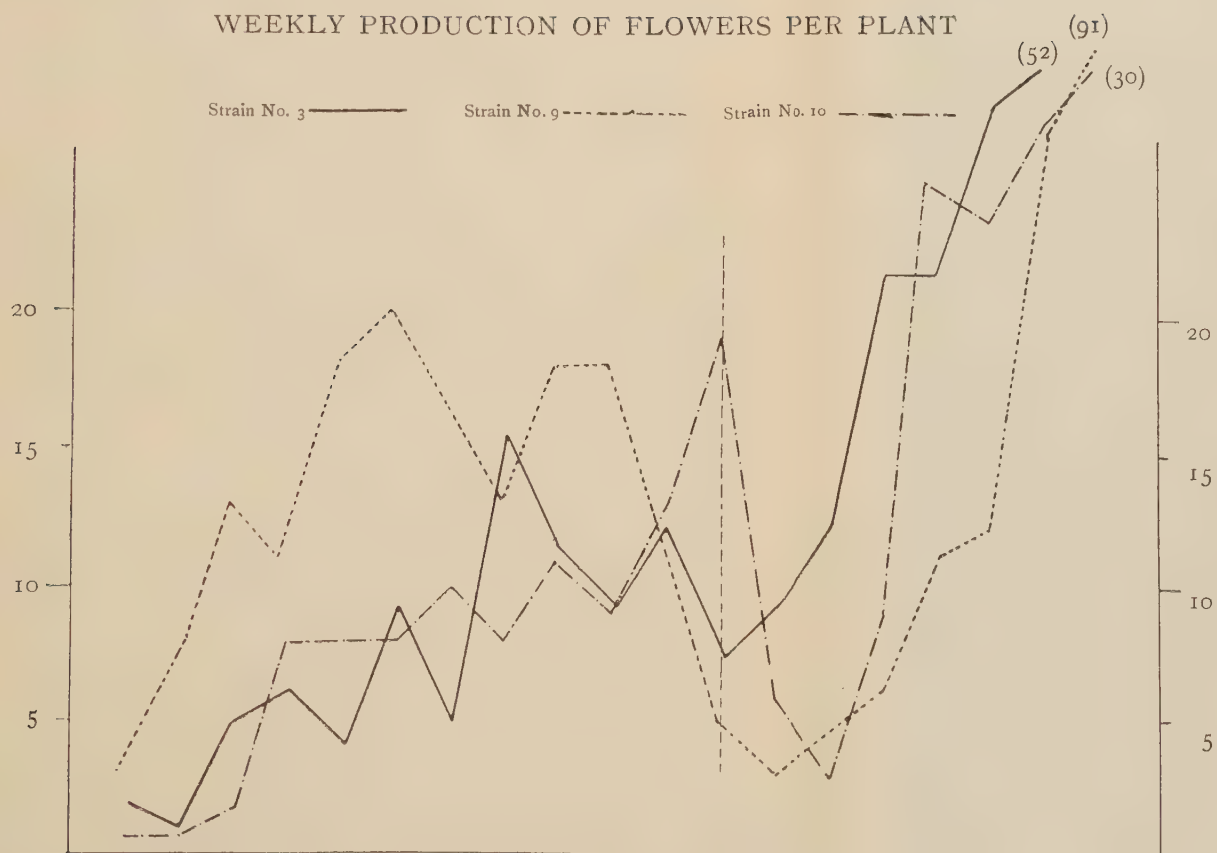


FIGURE III.

WEEKLY PRODUCTION OF FLOWERS PER PLANT



NOTE —The curves have been contracted towards the end as shown by the figures in brackets.

The vertical dotted line shows the date after which no flowers produced can mature bolls before Nov. 1.

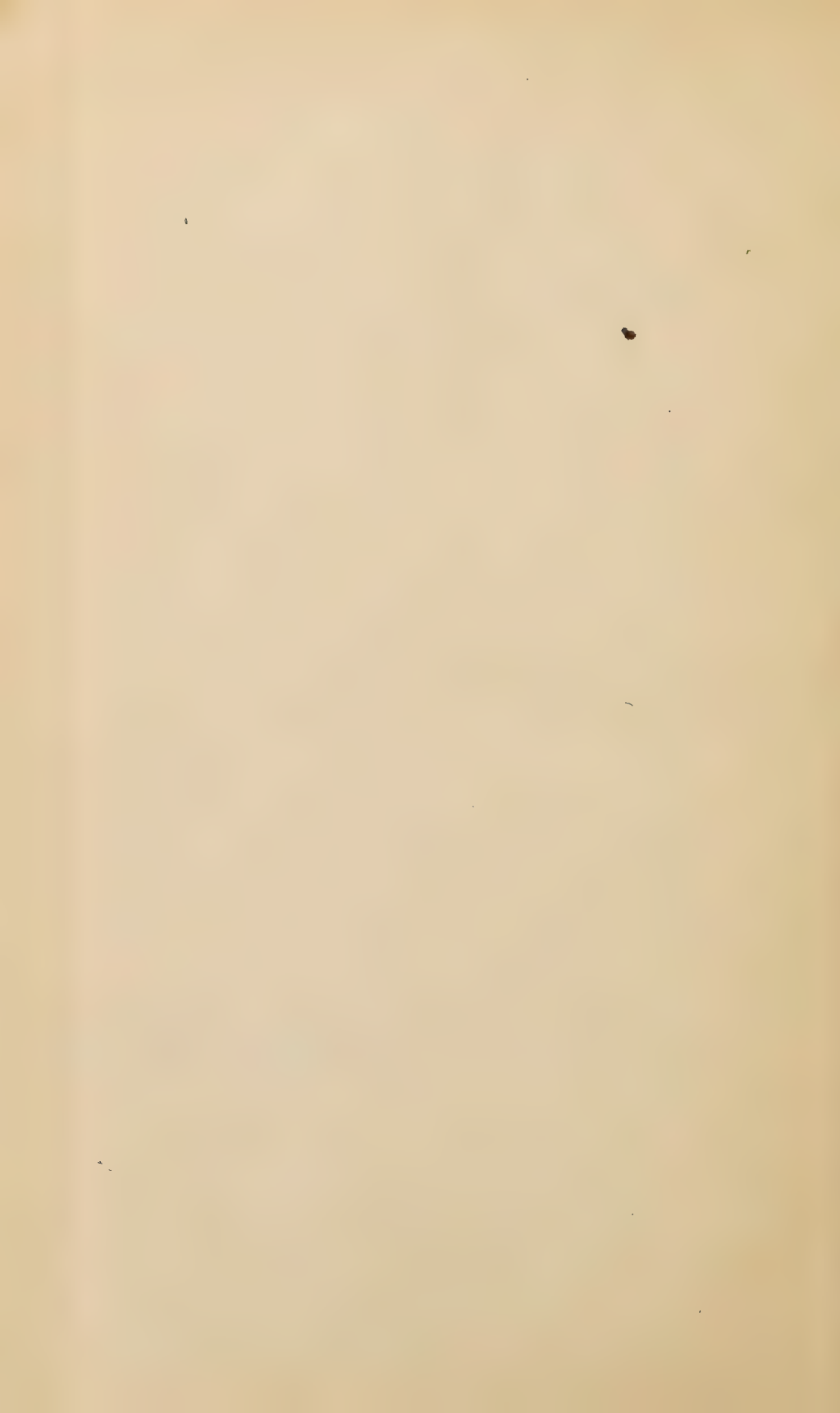
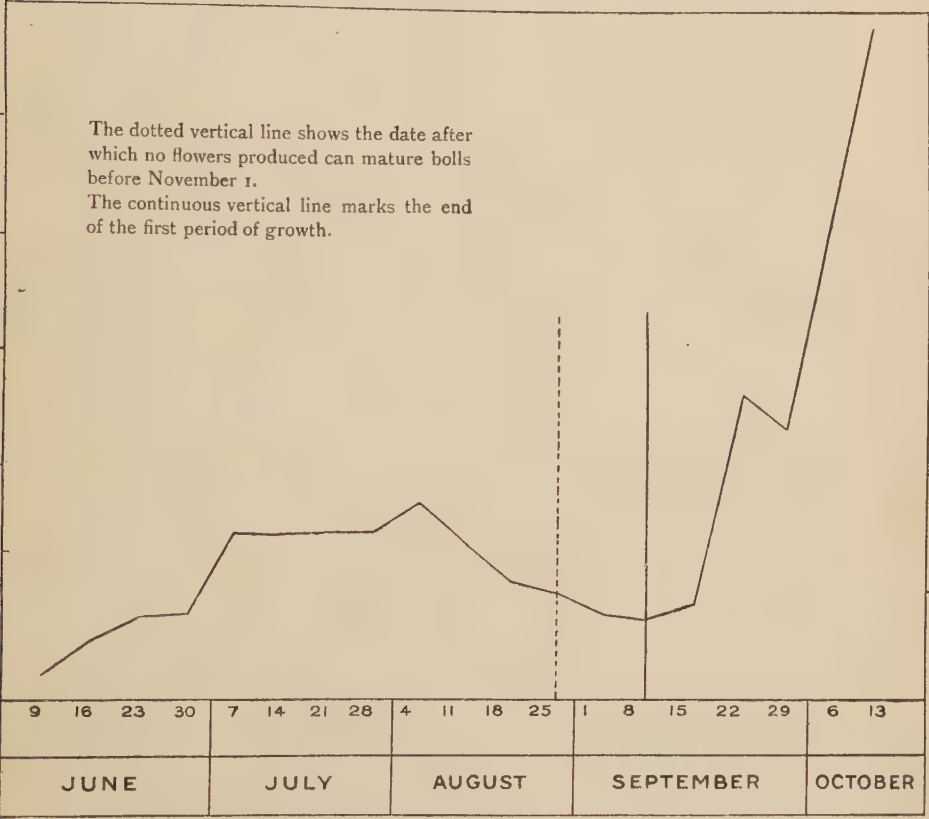


FIGURE IV.

WEEKLY PRODUCTION OF FLOWERS PER PLANT
(Data from 82 plants)



November 15, as it was in the year under report, and allowing, over and above the ten weeks from flower to boll, a fortnight for clearing and burning, it is clear that no flower produced after August 25 is going to produce anything. The point is shown graphically in Fig. IV. It may be noted that the later produced flowers do not all represent lost bolls, since many—most in fact—would be attacked with boll-worm and give only a little stained cotton.

(d) *Other Records*.—Attempts were made to record the factor $\frac{\text{diameter}}{\text{length}}$, but the material was too poor to produce anything reliable.

The colour of the stem was a factor which was found too unreliable for practical purposes. Hairiness was another elusive character, and attempts to record this character were dropped. Observations on the fuzz on the seed showed that there was still considerable variation within the strain. **No. 5** was recorded last year as very fuzzy; this year all the plants but one produced very fuzzy seed; a similar result was obtained in **No. 6**; **No. 9** showed a good deal more variation; one plant showed great fuzziness, two others were similar but less fuzzy, two were intermediate, and four were distinctly darker.

Received, May, 1925.

NYASALAND

REPORT ON THE WORK OF THE COTTON EXPERIMENT
STATION, MAKWAPALA, FOR THE YEAR JANUARY 1
TO DECEMBER 31, 1924

BY

H. C. SAMPSON, C.I.E.

ALL the buildings that we are likely to require have been completed in the course of the year. They are all substantial and well finished, and I am very satisfied with the way in which our temporary overseer has carried out the work. All that now remains to be done is ceiling the store rooms to keep out rats, etc. For this purpose we are using $\frac{1}{2}$ -inch mesh wire netting, which is still on rail from South Africa. The buildings were unfortunately considerably delayed, owing to the overseer in charge of the work going down with "blackwater." He remained in hospital for six weeks, and his illness naturally increased the cost of the work.

Opportunity was taken of the presence of this overseer to build a bridge over the Matawala stream. Our new road to the station crosses this stream where it enters the station, and as there may be 14 feet of water in the stream during heavy rains a bridge was considered essential. This meant building three piers of stone set in cement to cover the wooden superstructure. Timber for the latter was supplied gratis by the Blantyre and East Africa Company, on whose land the cotton station is situated. A very good job has been made of this work, and the bridge is capable of carrying any traffic—even 4-ton lorries which have been used for transporting our building materials.

We have virtually taken over the maintenance of the road out to the station. Last year we received a grant which enabled us to clear the road and the cambering, and this financial year we have received a further grant which should enable us to keep the road in good repair throughout this coming year. This should attract more visitors during the growing season, as people are loth to risk breaking their car springs on roads which they do not know.

Four boys for working the cattle were recruited from the Dutch mission and from the White Fathers mission in Angoniland, which missions I am trying to interest in working light bullock-drawn implements. The bullocks are now fairly well broken in, though improvement is still desired in the straightness of the work done.

This, however, will only be possible when we get the cattle working at inter-cultivation. Then I anticipate that they will learn to go straight quicker than the boys, as the African native has very little idea of a straight line. The animals are in excellent condition. They are well fed, groomed, and housed, and are capable of doing eight hours' work a day.

Of the 65 acres which are laid out into 12 experimental blocks, each of 5·4 acres in extent, 54 acres were planted with maize, which was grown in order to break in this virgin land to cultivation. Some 7 acres were planted with cotton varieties and selections; 1 acre was grown with tobacco for seed at the request of the Agricultural Department, who have closed down their Agricultural Station at Namiwawa, pending the allocation of funds for opening a smaller station in a more suitable situation; and about 2 acres were planted with miscellaneous crops which it was thought might prove suitable as rotation crops for cotton.

The area under maize had to be worked at first by manual labour, as the land was still so full of the roots of the trees which had been felled that it was impossible to work draught implements. The crop received in all three hoeings, the first being fairly deep, in order to aerate the soil, and the two latter being shallower, with the object of preserving a soil mulch and of keeping down weeds. It was remarkable how this cultivation saved the land from wash. Even a heavy fall of 6·7 inches of rain received in one day had very little effect on it, most of the water being absorbed by the loosened soil. The maize crop, as one would expect where the ground was still full of rotting vegetable matter and roots, was very uneven in growth. On the whole, however, the crop was much above the average of crops grown on newly cleared land. A careful lookout was kept for weeds which might in the future prove obnoxious. There were several patches of *Imperata* grass which were carefully weeded out, but it is doubtful whether this would ever become a serious pest here on account of the long dry weather, which gives an opportunity for ample preparatory cultivation. There were also a few patches of *Striga coccinea*, a parasitic weed on certain cereals, especially maize and sorghums. This it is hoped to keep in check by a suitable rotation of crops. Men were employed the whole time in digging out tree roots, so as to make it possible to use ploughs when the crop had been harvested, which was completed by June.

The plants were cut to the ground and then stooked on the roadways separating the fields. Here they were allowed to dry out and ripen up their cobs for some five weeks. This enabled us to start ploughing as soon as the crop was off the fields—*i.e.*, before the moisture had dried out of the soil and before any weeds had a chance of seeding. The first ploughing was completed by the first week in

May. This work was done with Ransome's "Jat" plough, and approximately half an acre was covered a day with each plough, worked with a single pair of bullocks and one boy. This reduced the cost of ploughing to a minimum, which worked out at 1s. 5d. per acre for man labour employed. As soon as the first ploughing was completed the land was cross-ploughed. The yield of maize obtained from some 55 acres was about 35 tons of maize in the cob, which may be considered quite a good yield for newly opened up land.

Ten of the varieties of cotton which I procured from America were sown in 4-foot rows and 2 feet apart in the row in areas occupying approximately $\frac{1}{10}$ acre each. Most of the rest of the area was sown 4 by 4 feet apart, which gave the plants room to develop their vegetative characters freely. These sowings consisted of all the single plant selections retained from last year's selection work and areas sown with seed obtained from different parts of the country from which to make further selections this season. The main sowings were completed before the end of December. Germination was disappointing in some cases, though it was expected that this would not be too good on account of the stained nature of the lint from which the seed was obtained. The single plant selections, which last year were grown on the lower river, were very disappointing, and very few seeds germinated.

When the cotton commenced to form squares it was apparent that we were in for a severe attack of red boll-worm. Accordingly all the flowers and flower buds on every plant were stripped. This was done with the object of trapping all the first brood of caterpillars. After this stripping a portion of the area was dusted with a weak mixture of Paris green and ashes (1 in 20). This was done with a view to poisoning any small caterpillars which might hatch out on the plants, and which would be wandering about the plant in search of squares. After fresh squares were formed on the plants all those which opened wide their bracts—a certain indication of red boll-worm damage—were hand-picked. It was found that the numbers of such flared buds on the area which had not been dusted with Paris green were greatly in excess of those on the area where dusting had been done. This method of dealing with the pest is not expensive in a country of cheap child labour such as this, and it is possible that it can be improved upon. For example, in districts where cotton is not sown till after January, it would be quite possible to sow earlier a few trap rows of cotton, which could be removed entirely before the main crop showed signs of forming squares. One adverse effect of dusting with Paris green was the rapid development of the aphid. This, however, was only a passing phase, for as soon as the young plants had made new growth, the natural enemies of

the aphids again appeared in large numbers and soon managed to keep this in check.

The preliminary after-cultivation of the cotton area was done by hand, but as soon as the plants were large enough this was all done with the blade drawhoes, and only hand weeding around the plants was necessary after that. In this area, which had formerly been native gardens, weeds were very bad, but we were able to keep these quite easily in check by getting the hoes on to the area before the weeds had got big enough to become firmly established. In another season hand hoeing will be unnecessary, as several of our boys are now skilled in working the drawhoe, and can carry out the work without damaging the young crop.

During the growing season much of Mr. Ducker's and my time was spent in going through the various strains of cotton. The work consisted of marking selected plants, selfing the flowers by sewing these up before they opened, and in picking the crop separately from all selected plants. Handling the plants for selfing has a very adverse effect both on the growth and bearing. This was very noticeable in the field of "Over the top" cotton. Here, after roguing, two whole rows were selfed in this manner, and the difference in growth and bearing of these two rows was very marked when compared with the rest of the field.

The cross-ploughing where the maize had been was completed on July 10. The cotton plants were pulled out at about the same time, and this land was also ploughed and cross-ploughed. The surface cultivation which we had given to the cotton land had a remarkable effect on its growth. Where other cotton in the neighbourhood had turned red and stopped growth, ours remained a healthy green and promised to give quite a good second crop, but as there was ample evidence that the crop was increasing in boll-worm rapidly, it was pulled out and burnt.

After the ploughing was completed, attention was given to levelling down ant heaps. A bullock shovel, which we made on the station, proved most useful in this work in conveying the soil to fill up depressions. Two field blocks which were liable to wash, as they had too steep a slope, were divided into strips and bunded on the lower side. It is hoped that these, in time, will silt up and form level terraces. After this work was completed, the fields were all cultivated and cross-cultivated with a heavy blade hoe or Indian cultivator introduced from the Central Provinces. These, in the future, will prove most useful implements, though, till the land is free of roots, considerable delays occur on account of breakages due to the blade catching on hidden stumps. The fields were then left till the receipt of the rains. They were all in excellent tilth, though the area where cotton was last season is rough, because ploughing did

not commence till much of the moisture in the soil had gone. Further, the land was by that time pretty well packed, as the whole area had been devoted to cotton selections and had been well trodden over.

Various other crops which were grown in small areas as likely to prove useful as rotation crops were also harvested, while an experimental sowing of chickpea was made on land where tobacco had been harvested. This pulse crop grew quite well on the moisture left in the land after the rains.

The rains were very late in arriving this season, and it was not until December 17 that we received any rain. On that day we received 1.44 inches, and it looked as if the rains had really broken. With this rain we started sowing and were able to sow some 45 acres. However, no further rain fell till December 28, and as the intervening weather was very hot with bright sunshine, it looked as if much of the young growth would wither. We were getting quite anxious about our cottons which had been sown. However, the rain came just in time, and though there is not quite a full stand, as some of the plants withered, it is quite fair. The single plant selections suffered most. These were all sown 4 feet by 4 feet, and quite a number of the plants which germinated withered off or were eaten off by crickets. Fortunately some of the seed had not germinated with this rain, and has come up subsequently, and there is a very fair stand of most of these plots. We have in this year some 22 acres of cotton, of which about 8 acres are "Over the top." Two very noticeable things were observed regarding germination in the field. All seed newly imported into the country was dressed with concentrated sulphuric acid, in which it was soaked for ten minutes. This naturally dissolved off all the fuzz. All such dressed seed showed above ground within three days, while undressed seed took from twenty-four to thirty-six hours longer to show, and even then it did not germinate nearly so evenly. For select cottons dressing the seed in this way has a distinct advantage, as after three days it is possible to see where there are blanks, and these can be filled in at once without any really appreciable difference in the date of sowing.

Cotton seed which was sown with the rain of December 17 and which failed to germinate with that rain took from five to some eight days to germinate after the receipt of the next rain. In fact, sowings made on January 1 were all well up on January 4, whereas seed which had been lying in the ground since December 19 was only just breaking through at the same time.

The sowings were all completed by December 31—at least, of everything which has to be sown at the commencement of the rains. Some of the rotation crops—viz., 5 acres of tobacco and 1 acre of *Eleusine coracana*—have still to be planted, and about 2 acres of

beans and $2\frac{1}{2}$ acres of sesamum have to be sown. These latter will be sown at the end of January.

The sowing season has been particularly busy and trying. We have endeavoured, as far as possible, to make our labour more efficient by the use of implements. All our sowings have been done with the use of markers. These are light wooden structures, each marking two lines at once. Two men work these, one drawing and the other guiding behind. The cotton lands were all marked with these, and two boys could mark 5 acres a day of 4-foot rows. The sowing was all done by dibbling in seed with the hoe, as it was necessary this year to make our supply go as far as possible. We had made 3-foot markers for sowing smaller crops. For sowing small seeds we used long tin funnels, which were hung round the sower's neck, and he dropped the seed down the funnel into the open furrow as he walked along. Seed sown in this way was either covered with a blade hoe or a brush harrow made of thorns. We have this year been able to see what acreage can be worked with the manual blade drawhoe for inter-cultivation, and we find that two men can do over 1 acre a day. Several of the fields which were sown after the rain in the middle of December had to be worked with these in order to retain the moisture.

During the year preparations have also been made for planting up with trees a portion of the land sloping down to the stream which was unfit for experimental crop production. This work is essential, both to meet our future requirements of agricultural timber and to conform with the Government rules regarding afforestation. Over 4,000 seedlings of *Cedrela toona*, obtained from self-sown seedlings in the Government Arboretum at Zomba, were first grown in nurseries, and then planted out in the rainy season. We have also sown at stake some 3 acres of *Cassia siamea*. We have still to plant about 2 acres of gums, and an area has been set aside for teak, which will be planted as soon as the seedlings are ready.

Altogether I consider that we are making very considerable progress in the use of simple implements. It is a question which the European in this country must take up, because each year, as the native is becoming more and more a producer of export crops, labour is becoming more difficult to procure, and therefore what labour is available must be made more efficient. If the European once takes to such labour-saving implements, it is more than likely that in time the native will copy him.

The station is already beginning to attract considerable attention among planters interested in cotton cultivation, and we have frequent visitors there.

WEST INDIES

THE VARIETY TEST WITH SEA ISLAND COTTON,
ST. VINCENT, 1923-1924

BY

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HITHERTO, so far as the author is aware, no variety test with cotton has been undertaken in which even comparatively complete sets of data have been obtained from the sowing of the seed right up to the final production of the yarn, and little or no information has been available which might be expected to demonstrate the existence, or otherwise, of correlations between the growing and spinning characters of a cotton. In this respect it is fully realized that the test to be described is far from ideal, but it is probably more complete than any carried out up to the present, and although the results cannot be described as conclusive, it seems worth while to put them on record, if only for the purpose of illustrating some of the difficulties which beset work of this nature.

The immediate purpose of this test was to find out the relative yielding capacities of the various pure strains growing on the Experiment Station, with a view to the future trial of one or more of them under estate conditions. It was also hoped that the full sets of data available might show some correlations with the results of the spinning tests, though this was considered very unlikely.

The nine pure strains tested were V 135, AJ, AN, GX 12, GX 12V, BD, AE, BF, and H 23. So far as can be ascertained, in the absence of records,* all of these, with the exception of H 23, were originally isolated by Harland during his tenure of office in St. Vincent. The H 23 is one of the Heaton strains established by Robson in Montserrat.⁸ The eye differences between them are not very marked, but slight colour variations in leaf and petal, and differences in habit, and the shape of the leaves and the bolls, enable one to separate the various strains, if not to identify them.

FIELD ARRANGEMENTS

There were four $\frac{1}{40}$ acre plots of each strain arranged chessboard fashion (Fig. I.) and labelled in the field with serial numbers instead of their actual names, so as to avoid bias on the part of the observers.

* We have since obtained some early records for strains AJ, AN, BD, and BF, which show that their isolation was begun in 1915. They have, therefore, now been self fertilized for ten years, which renders the chances of genetic impurity rather remote.

The site was the best that could be found on the Experiment Station, but there is evidence that the soil was far from uniform.

Cultural operations were as follows: Manurial treatment, leguminous green dressing only, seed sown July 24, 1924. Banks 4 feet apart, holes 18 inches apart on the banks. Plants subsequently thinned to one plant per hole. In this way each plot contained 168 plants in 8 banks of 21 plants each. The plots were kept constantly weeded until the shade was so dense that weed growth ceased.

DATA AVAILABLE

The data available for discussion in the present case are:

Meteorological.—Daily rainfall and temperature records, wet and dry bulbs throughout the season.

Daily evaporation rates, total and due to solar radiation, from Livingstone atmometers in the field throughout most of the growth period.¹ Weekly wind speeds.

PLANT DEVELOPMENT

Daily growth records from one plot of strain BF.

Daily flowering, bolling, and boll-shedding records for all the thirty-six plots.

LABORATORY

Mean weight of lint per boll for all strains except H 23.

Mean maximum lint length, lint index, and ginning out-turn for all strains. Daily pickings for one plot of strain BF, for daily variations in lint length, lint index, and ginning out-turn.

Distributions of lint length by Balls' sledge sorter.

SPINNING

(By the courtesy of the Fine Cotton Spinners' and Doublers' Association, Experimental Department.)

Scutcher, comber and card losses.

Lea test. Strength at 240's counts.

Weight per cm.

Hair strength.

Strength per unit weight.

These data will now be considered in detail.

Meteorological and Growth.—The atmometers were read at 8 a.m. Measuring on the plot of BF was from an ink-mark at the cotyledonary node to the base of the terminal bud, and was begun daily at 7 a.m.

There is evidently some distinct relationship between the total daily evaporation and the daily increase in stem height,² but there

are, of course, discrepancies where high evaporation rates are accompanied by low growth rates such as September 5 and October 23. Some of these disturbances may be accounted for by other factors such as high winds. It is, however, presumed that the daily fluctuations in growth rate affect all strains equally, and their elucidation is rather a matter of plant physiology than variety testing (Fig. II.).

The temperature variations were small and apparently of no significance.

The daily growth alone, however, is interesting, as it gives an insight into the probable rate of flowering,³ and it is regrettable that growth records were not obtained from all the strains, as it might then have been possible to forecast some of the inter-strain differences in flowering (Fig. III.) which were manifested later.

The evaporation due to solar radiation was apparently of no importance.

FLOWERING

These records were made daily from all plots, omitting from the observations all outside plants, so as to avoid errors due to marginal effects.* The figures for mean flowers per plant per day show considerable fluctuations, due largely to variations in the rate of growth twenty-eight days previously; and in dealing with the records, the figures have been smoothed by overlapping five-day means.

The actual figures, as recorded daily, are very extensive, and are identical in principle with those published by Balls in his original account of the method.

From the flowering curves reproduced (Fig. IV.) it will be noticed that the curves all have two maxima, one at October 14 and another about October 26. Between these dates the strains seem to fall naturally into three groups: V 135, flowering at the greatest rate, GX 12, AN, and AJ, intermediate, and H 23, AE, GX 12V, BD, and BF, slowest. There is a difference of about four days between the earliest (AJ) and the latest (H 23) maturing strains.

The particular node on the main stem at which the first fruiting branch arises varies somewhat in different strains, and it is probable that specific differences in respect of this character cause the variations in time of flowering.

These records alone would be of great value in estimating the yielding capacity of the strains, were it not for the very great variations in the incidence of boll shedding. The actual figures for total number of flowers produced are given in Table I. They indicate, neglecting boll shedding and other losses, the maximum potential crop.

* Subsequent investigation has shown that the lateral roots of cotton plants may develop a length of between 6 and 7 feet, so that the marginal effect is probably not avoided in its entirety by excluding outside plants only.

BOLL SHEDDING

The fallen bolls in the furrows between the rows of cotton were picked up daily and counted, only *half* the number found in the outer furrows being credited to the plot, since the outside rows had been omitted from the observations, to exclude marginal effects.

This procedure is a compromise, for when a boll has fallen to the ground in a furrow, it is clearly impossible to tell from which of the two rows on either side it has come, but it is probable that errors introduced in this way tend to average out over the four plots, and will not materially affect the results. Ideally one would like to trace the exact fate of every flower and bud in the plot, using the plant diagram method evolved by Harland,⁷ but this would be impossible without an unlimited staff of trained observers.

The curves finally obtained of sheds per plant per day, smoothed in the same way as the flowers, are reproduced in Fig. V.

They are broadly similar for all strains except AJ, which rises very much higher and earlier than the remainder. There is evidently some positive correlation between number of bolls shed and flowers produced. The actual percentages of sheds to flowers for the various strains are shown in Table II.

The variations in shedding percentages are very marked, and, as pointed out, vitiate somewhat the value of the flowering curves in elucidating the inter-strain relationships.

In general these percentages seem to be less than those found by Balls in Egypt.⁵

THE BOLLING RECORDS

These were obtained daily, and in plotting the curves (Fig. VI.) have been smoothed by overlapping five-day means, as for flowering and shedding. All the curves are very irregular on account of checks in flowering, and waves of boll shedding. As in flowering, AJ leads at first but soon loses its superiority through boll shedding, and finally comes out bottom for total production of bolls. For the actual yield of bolls see Table III.

The weights of seed cotton expected will not be strictly in proportion to these numbers, as there are considerable fluctuations in weight of seed cotton per boll, and it is possible that the incidence of pests and diseases and other disturbing factors may fall unevenly on the various plots. The actual weights of seed cotton per plot are, however, interesting, as they bring to light the (moderate) amount of soil heterogeneity which exists in the field. They are summarized in Table IV.

It will be noticed that there is considerable variation in the yield of nominally identical plots, particularly in strains AE, BD, BF,

and H 23, and reference to the plan (Fig. I.) will show that the depreciated plots are gathered together in a strip in the centre of the field. A mathematical method of correction for such soil heterogeneity, on the basis of the contingency method, has been devised by Pearl and Surface,⁶ and when this is used the corrected yields per acre for the various strains are as shown, in order of merit, in Table V. A comparison will show that the order of the strains is not materially altered by this correction method.

The grower, however, is primarily concerned with the weight of lint per acre, and we can now estimate this for all the strains in two different ways—either by multiplying the total number of bolls produced, by the mean weight of lint per boll, or by multiplying the actual weight of seed cotton produced, by the ginning out-turn of the strain in question. The results of both these methods are given in Tables VI. and VII.

These sets of figures are widely different in general, but they agree in placing AN nearly first and BF and V 135 nearly bottom. The calculated yield of BD is remarkable (600 lbs. of lint per acre).

The order obtained by using the ginning out-turn figures for the two years, 1923 and 1924, are identical with the exception of V 135 and BF, which have changed places, and this is a tribute to the accuracy with which these determinations have been made; it also tends to show, apart from statistical information, that the strains are all pure—at least for percentages of lint to seed cotton. If this were not so, it would be unlikely that the strains would retain their order through the annual fluctuations of this character.

The estimates from lint per boll and total bolls probably represent the real state of affairs better than those from seed cotton and ginning out-turn, for these latter depend upon the actual weight of seed cotton picked—a feature which is much more liable to disturbance than the total number of bolls. We may take it, then, that BD, GX 12, and AN are the best yielders, and BF, V 135, and possibly GX 12V, are the worst.

LABORATORY DETERMINATIONS

Figures for mean boll loculi number, ginning out-turn, lint index, lint per boll, and maximum lint length, are available for the seasons 1922-23 and 1923-24. They are summarized in Table VIII. They are the means of observation on not less than, and frequently more than, 500 seeds for each pure strain.

As previously mentioned the ginning out-turns are in approximately the same order for both seasons. The character number of loculi per boll is similar. It will be observed that the strains fall readily into two groups with regard to this character, and it would

seem probable, *re* the genetics of boll loculi, that the strains in each group have the same constitution. Weight of lint per boll has already been noticed, and, contrary to expectations, the correlation between it and boll loculus number does not seem to be at all marked.

Lint index is also substantially the same for the two years, and there is a distinct correlation between it and lint per boll. The weights were all higher in 1922-23 than in 1923-24. This depression was evidently seasonal, as we have since found that the 1924-25 figures are almost identical with those of 1922-23.

Lint per boll is clearly a character of great importance, since the final yield of a strain equals the number of bolls multiplied by lint per boll. Now the weight of lint per boll depends upon weight of lint per seed, number of seeds per loculus, and number of loculi per boll. These characters fluctuate, but probably not independently, and we require some method of integrating the various items. Since lint per boll, as already mentioned, does not appear to be markedly correlated with boll loculi, it may be that the number of seeds per loculus varies inversely as the number of loculi per boll. Possibly the number of seeds in a loculus which mature is influenced by the size of the loculus itself, in a purely mechanical way. Information on these points is at present lacking.

The lint lengths deserve comment. As will be noticed, they are all shorter in 1924 than in 1923. This is no doubt due in part to the variable personal factor in combing, which was done by different persons in the two seasons, but the major part of the depression was due to the adverse seasonal conditions. This was demonstrated by the daily pickings (Fig. VII.).

DISTRIBUTION OF LINT LENGTH BY SORTER⁴

These results are somewhat disappointing. All the strains seem to be very similar, and V 135 excepted, the difference between the various strains as shown by the machine do not seem to be significant. The values of CV, calculated from the weight distributions, were remarkably constant, and the small differences between them were of about the same magnitude as their probable errors. Curves showing the difference between AE and the extra long V 135 are shown in Fig. VIII. (1924-25 crop).

THE DAILY PICKINGS

These were samples collected daily from dated flowers, from one plot of strain BF; a careful laboratory examination was made of each of them, and the daily variations in the contents of the bolls were brought to light. The only point of importance to the problem in hand was the marked depression in lint length, from flowers opening

in October (Fig. VII.). These constitute the bulk of the crop, and this accounts for the fact that the lint lengths generally in 1924 were less than in 1923.

SPINNING.

By the courtesy of the Fine Cotton Spinners' and Doublers' Association, spinning tests were carried out on the nine samples, at their Experimental Department, Bollington, under the ægis of Dr. W. L. Balls. These results are given in full in the appendix.

The salient feature of these spinning tests is the superiority of all our nine strains over the control sample of West Indian Commercial Mixing; reduction of comber waste is considerable, but the most striking difference of all is the hair strengths per lint weight, where our best strain in this respect (AJ) beats the control by 47 per cent.

The inter-strain differences are interesting, and in some cases the results seem almost paradoxical.

Losses in Preparation at Scutcher, Card, and Comber.—GX 12V seems to be even more wasteful than V 135, but this comparison is invalid since V 135 was "staple too long to work alongside the others in preparation." BF, H 23, BD, and AE have comparatively small comber losses.

Strengths at 240's—lea tests.—BF, the strongest, H 23, AE, and AJ surprisingly low. Slight correlation with weight per cm. Apparently no correlation with hair strength.

WEIGHT PER CENTIMETRE

H 23 comes out with a much higher weight than we expected—some correlation with hair strength.

HAIR STRENGTH

The figures expressed as strength per lint weight of 0.001 mg. are best for comparative purposes. They are all very high, and there is a slight correlation with weight per cm.

RELATION BETWEEN THE MEASURABLE CHARACTERS OF THE RAW COTTON AND THE SPINNING PERFORMANCE

Results in this direction are disappointing, though perhaps, with our limited knowledge of what really happens to the cotton during the various spinning processes, nothing more should have been expected.

Various correlation diagrams are shown (Fig. IX.), and there is some indication of negative correlation between weight per cm. and strength at 240's, though there appears to be no relation between hair strength and the weight of single hairs.

SUMMARIZED REPORT ON EACH STRAIN

- BD.—Flowering not conspicuously high, maximum 2.04 flowers p.p.p.d. Shedding, 34 per cent. Bolling normal. Large percentage of 4-lock bolls (mean, 3.6), hence has high weight of lint per boll (1.02 grammes). Ginning out-turn, 28 per cent. Mean maximum lint length, 51.0 mm. Weight per cm., 0.00104 mg. Hair strength, 3.33. *Spinning*.—Scutcher loss, 1.2 per cent. Card loss, 7.0 per cent. Comber loss, 26.0 per cent. Total loss, 34.2 per cent.—a low figure. *Yarn*.—Strength at 240's lea test, 17.5. Possibly not yet pure for lint index. Has risen to 5.22 in 1924-25.
- AN.—Occasionally throws rogues (mutations?) with white flowers and maximum lint length, 40 mm. Stems, branches and leaves rather larger and stronger than usual. Somewhat resistant to angular leaf spot. Flowering normal, maximum 2.26 flowers p.p.p.d. Shedding, 43 per cent. Bolling normal. Recognized for some years as a high yielder, which yield is almost certainly due to high ginning out-turn (32 per cent.). Lint per boll high, 0.96 grammes. Mean maximum lint length, 50.3 mm. Lint index, 5.45. Weight per cm., 0.00119 mg. Hair strength, 4.51. *Spinning*.—Scutcher loss, 0.6 per cent. Card loss, 7.0 per cent. Comber loss, 27.7 per cent. Total loss, 35.3 per cent. *Yarn*.—Strength at 240's lea test, 16.0.
- GX 12.—Probably not pure at the time of the test. There are indications of the presence of two genetically distinct groups. Flowering reaches a higher maximum than most, 2.23 flowers p.p.p.d. Shedding, 32 per cent., quite low. Bolling normal, lint index high, 5.19. Ginning out-turn, 29.17 per cent. Lint per boll, 1.11 grammes. Mean maximum lint length, 50.9 mm. Weight per cm., 0.00101 mg. Hair strength, 3.85. *Spinning*.—Scutcher loss, 1.3 per cent. Card loss, 7.5 per cent. Comber loss, 27.7 per cent. Total loss, 36.5 per cent. *Yarn*.—Strength at 240's lea test, 17.7.
- GX 12V.—Flowering low at first, but later rises to a maximum of 2.05 p.p.p.d. Shedding very low, 25 per cent., and so produces more bolls per plant than any other strain. Low ginning out-turn, 24 per cent. Lint per boll, 0.82 gr. Mean maximum lint length, 52.8 mm. Lint index, 3.9. Weight per cm., 0.00108 mg. Hair strength, 3.75. *Spinning*.—Scutcher loss, 1.8 per cent. Card loss, 7.7 per cent. Comber loss, 29.8 per cent. Total loss, 39.3 per cent. The most wasteful strain at the mill. *Yarn*.—Strength at 240's lea test, 17.3.
- AE.—Flowering a little low, maximum 2.08 flowers p.p.p.d. Shedding low, 27 per cent. Bolling higher than most, especially towards the end of the bolling period. Ginning out-turn, 27 per cent. Lint per boll, 0.884 gr. Lint index, 4.78. Lint length, mean maximum, 52.0 mm. Weight per cm., 0.00116 mg. Hair strength, 4.28. *Spinning*.—Scutcher loss, 0.3 per cent. Card loss, 7 per cent. Comber loss, 26.5 per cent. Total loss, 33.8 per cent. Lowest wastage at the mill. *Yarn*.—Strength at 240's lea test, 15.8, distinctly low.
- BF.—Flowering rather low, maximum 2.04 flowers p.p.p.d. Shedding also low, 30.5 per cent. Bolling normal. Boll loculi high, 3.69. Lint per boll low, 0.787 gr. Lint index, 4.26. Ginning out-turn, 28.78. Mean maximum lint length, 53.0 mm. Weight per cm., 0.00105 mg. Hair strength, 3.87. *Spinning*.—Scutcher loss, 1.4 per cent. Card loss, 7.9 per cent. Comber loss, 25.3 per cent. Total loss, 34.6 per cent. Wastage low. *Yarn*.—Strength at 240's lea test, 18.0, very high.
- AJ.—Flowering earlier than all other strains. Maximum, 2.46 flowers p.p.p.d. Shedding very high, 44 per cent. Bolling, the earliest strain, as for flowering, with the fall of the bolling curve exaggerated by shedding. Ginning out-turn, 32.17 per cent. Lint index, 5.35. Lint per boll, 0.973 gr. Lint length, 51.1 mm. Weight per cm., 0.00105 mg. Hair strength, 4.28. *Spinning*.—Scutcher loss, 1.1 per cent. Card loss, 7.3 per cent. Comber loss, 28.7 per cent. Total loss, 37.1 per cent. *Yarn*.—Strength at 240's lea test, 15.3, very low.

- V 135.—Very high flowering rate. Maximum 2.58 flowers p.p.p.d. Bolling not above average. Shedding, 32.7 per cent. Not a good yielder on account of low ginning out-turn, 24.5 per cent., and low lint per boll, 0.70 gr. Valuable on account of its extreme length of lint, 57 mm. Weight per cm., 0.00111 mg. Hair strength, 4.39. *Spinning*.—Scutcher loss, 1.5 per cent. Card loss, 8.3 per cent. Comber loss, 28.7 per cent. Total loss, 38.5 per cent. Rather too wasteful. *Yarn*.—Strength at 240's lea test, 17.6.
- H 23.—One of the Heaton strains imported from Montserrat. It can readily be identified by the shape of the boll.⁸ Flowering low at first, but climbs later to a maximum of 1.97 flowers p.p.p.d. Somewhat resistant to shedding, 28.4 per cent. Normal bolling. Ginning out-turn and lint per boll figures not available. Weight per cm., 0.00128 mg. Higher than the other strains. Hair strength, 3.94. When calculated as strength per unit weight, becomes the lowest of all strains. *Spinning*.—Scutcher loss, 1.4 per cent. Card loss, 7.9 per cent. Comber loss, 25.4 per cent. Total loss, 34.7 per cent.; this is distinctly low. *Yarn*.—Strength at 240's lea test, 15.5, a disappointingly low figure.

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TABLE I.

<i>Strain.</i>							<i>Number Flowers Produced.</i>
V 135	..	..	..	..	..	..	37,620
AJ	..	..	..	..	..	..	35,403
AN	..	..	..	..	..	..	33,735
GX 12	..	..	..	..	..	..	33,280
GX 12V	..	..	..	..	..	..	32,804
BD	..	..	..	..	..	..	31,088
AE	..	..	..	..	..	..	30,987
BF	..	..	..	..	..	..	29,892
H 23	..	..	..	..	..	..	28,957

TABLE II.

<i>Strain.</i>							<i>Sheds to Flowers Produced.</i>
AJ	..	..	..	..	..	..	43.4 per cent.
BD	..	..	..	..	..	..	33.8 "
AN	..	..	..	..	..	..	32.9 "
V 135	..	..	..	..	..	..	32.7 "
GX 12	..	..	..	..	..	..	32.1 "
BF	..	..	..	..	..	..	30.5 "
H 23	..	..	..	..	..	..	28.4 "
AE	..	..	..	..	..	..	27.0 "
GX 12V	..	..	..	..	..	..	25.1 "

TABLE III.

<i>Strain.</i>							<i>Number Bolls Produced.</i>
GX 12V	..	..	..	..	..	..	22,657
AN	..	..	..	..	..	..	21,103
GX 12	..	..	..	..	..	..	20,088
BD	..	..	..	..	..	..	19,968
AE	..	..	..	..	..	..	19,405
H 23	..	..	..	..	..	..	18,030
BF	..	..	..	..	..	..	22,657
V 135	..	..	..	..	..	..	17,727
AJ	..	..	..	..	..	..	17,476

TABLE IV.

<i>Strain.</i>	<i>Plot Number.</i>	<i>Seed Cotton per Plot (Lbs.).</i>	<i>Seed Cotton per Acre (Lbs.).</i>	<i>Mean Seed Cotton per Acre.</i>
V 135	1	29.0	1,545	1,463
	11	28.0	1,493	
	26	26.5	1,413	
	36	26.5	1,400	
AN	2	28.25	1,567	1,619
	15	31.0	1,653	
	20	31.75	1,693	
	33	29.5	1,573	
AE	3	36.75	1,960	1,713
	10	31.25	1,667	
	21	30.5	1,627	
	32	30.0	1,600	
AJ	4	30.0	1,600	1,526
	13	28.0	1,493	
	19	29.25	1,560	
	30	27.0	1,440	
BD	5	34.5	1,840	1,619
	12	29.0	1,545	
	23	32.75	1,747	
	35	29.0	1,545	
BF	6	29.25	1,560	1,423
	14	23.0	1,127	
	24	25.5	1,630	
	29	29.0	1,545	
GX 12V	7	31.0	1,653	1,637
	18	34.5	1,307	
	28	32.0	1,707	
	25	34.5	1,840	
H 23	8	34.0	1,817	1,694
	17	29.25	1,560	
	27	31.0	1,653	
	34	32.75	1,747	
GX 12	9	28.0	1,493	1,517
	16	31.25	1,667	
	22	27.5	1,467	
	31	27.0	1,440	

Order of Merit.

AE, H 23, GX 12V, AN, BD, AJ, GX 12, V 135, BF.

TABLE V.—YIELD CORRECTED BY PEARL AND SURFACE'S METHOD.

<i>Strain.</i>						<i>Lbs. Seed Cotton per Acre.</i>
AE	..	..	..	..	..	1,668
H 23	..	..	..	..	..	1,649
BD	..	..	..	..	..	1,593
AN	..	..	..	..	..	1,583
GX 12	..	..	..	..	..	1,561
GX 12V	..	..	..	..	..	1,541
AJ	..	..	..	..	..	1,490
BF	..	..	..	..	..	1,464
V 135	..	..	..	..	..	1,424

TABLE VI.—LINT PER ACRE, ESTIMATED FROM ACTUAL YIELD OF SEED COTTON (UNCORRECTED) MULTIPLIED BY GINNING OUT-TURN.

<i>Strain.</i>	<i>1923 Figures.</i>	<i>Strain.</i>	<i>1924 Figures.</i>
AN	518	AN	439
AJ	493	AJ	418
H 23	493	AE	412
AE	475	BD	396
BD	452	GX 12	378
GX 12	448	GX 12V	327
GX 12V	391	V 135	327
BF	367	BF	302
V 135	359	H 23	No figures available.

TABLE VII.—YIELD PER ACRE IN LBS. OF LINT, ESTIMATED BY LINT PER BOLL MULTIPLIED BY TOTAL BOLLS.

<i>Strain.</i>	<i>1923 Figures.</i>	<i>Strain.</i>	<i>1924 Figures.</i>
BD	600	BD	588
AN	595	GX 12	556
GX 12	571	AN	527
GX 12V	535	AE	486
AE	520	AJ	479
AJ	498	BF	461
BF	420	GX 12V	411
V 135	382	V 135	332
H 23	No figures available for lint per boll.		

TABLE VIII.

Strain.	Boll Loculi.		Lint per Boll.		Lint Index.		Ginning Out-turn.		Mean Lint Length.	
	1922-23.	1923-24.	1923.	1924.	1923.	1924.	1923.	1924.	1923.	1924.
V 135	3.18	3.2	0.725	0.652	4.32	4.0	Per cent.	Per cent.	57.1	52.7
AN	3.16	3.19	0.961	0.848	5.45	4.8	24.48	21.9	50.3	50.3
AE	3.2	3.28	0.884	0.849	4.78	4.43	32.03	27.07	52.0	50.8
AJ	3.16	3.16	0.973	0.932	5.35	5.04	27.86	24.0	51.5	50.3
BD	3.6	3.52	1.02	0.998	4.8	4.26	32.17	27.4	51.5	50.3
BF	3.69	3.58	0.87	0.744	4.26	3.7	27.97	24.5	53.0	49.5
GX 12	3.75	3.57	1.11	0.945	5.19	4.52	25.75	21.2	50.9	47.7
GX 12V	3.65	3.59	0.802	0.614	3.98	3.22	29.17	24.9	52.8	50.02
H 23	—	—	—	—	—	—	24.03	20.1	—	—
							29.2	—		

TABLE IX.—SUMMARY OF RESULTS RECEIVED FROM THE FINE COTTON SPINNERS' AND DOUBLERS' ASSOCIATION:
1923-24 CROP.

Strain.	Scutcher Loss per Cent.	Card Loss per Cent.	Comber Loss per Cent.	Total Loss per Cent.	Strength at 240's.	Weight per Cm. in Mg.	Hair Strength.	Hair Strength per 0.001 Mg.
V 135	1.5	8.3	28.7	38.5	17.6	0.00111	4.39	3.95
AN	0.6	7.0	27.7	35.3	16.0	0.00119	4.51	3.79
AE	0.3	7.0	26.5	33.8	15.8	0.00116	4.31	3.71
AJ	1.1	7.3	28.7	37.1	15.3	0.00105	4.28	4.07
BD	1.2	7.0	26.0	34.2	17.5	0.00104	3.33	3.20
BF	1.4	7.9	25.3	34.6	18.0	0.00105	3.87	3.68
GX 12V	1.8	7.7	29.8	39.3	17.3	0.00105	3.75	3.57
H 23	1.4	7.9	25.4	34.7	15.5	0.00128	3.94	3.08
GX 12	1.3	7.5	27.7	36.5	17.7	0.00101	3.85	3.81
Control	—	—	29.8	—	15.6	0.00115	3.20	2.78

SPINNING TESTS ON ST. VINCENT, 1923 CROP (NINE SAMPLES):
SPINNING REPORT.

<i>Sample.</i>	<i>Scutcher Loss per Cent.</i>	<i>Card Loss per Cent.</i>	<i>Comber Loss per Cent.</i>	<i>Remarks.</i>
GX 12	1.3	7.5	27.7	—
AE	0.3	7.0	26.5	—
AN	0.6	7.0	27.7	—
AJ	1.1	7.3	28.7	—
GX 12V	1.8	7.7	29.8	—
BF	1.4	7.9	25.3	—
BD	1.2	7.0	26.0	—
H 23	1.4	7.9	25.4	—
V 135	1.5	8.3	28.7	Staple too long to work alongside the others in preparation.

TESTING REPORT

The yarns were spun to 250's counts and tested in two-lea tests, eight from each sample. As the counts came out rather low, the mean strengths were corrected to 240's nominal counts by the correlation method. Results of tests and means are given below.

<i>Sample.</i>										<i>Mean.</i>	<i>At 240's Counts.</i>
GX 12	Str.	17.0	15.2	17.0	17.5	15.9	17.0	19.9	16.7	16.9	17.7
	Ct.	242.8	242.2	241.2	242.2	248.8	244.6	239.2	242.4	242.9	
AE	Str.	13.5	16.0	16.0	13.0	14.5	16.0	14.5	15.0	14.8	15.8
	Ct.	252.0	242.6	238.6	252.6	244.6	244.0	244.6	249.6	246.9	
AN	Str.	14.0	23.5	15.0	14.0	14.0	15.0	15.0	14.0	14.3	16.0
	Ct.	249.6	249.0	247.0	249.6	245.8	245.8	242.2	247.0	247.0	
AJ	Str.	16.2	16.0	16.7	14.2	16.0	16.0	14.0	16.0	15.6	15.3
	Ct.	242.2	239.2	239.6	240.8	239.2	255.2	242.2	232.2	232.0	
GX 12V	Str.	19.0	19.0	18.9	18.0	20.2	18.0	18.0	19.8	18.9	17.3
	Ct.	237.0	236.4	236.4	237.2	236.0	237.0	237.0	236.0	236.6	
BF	Str.	19.0	20.7	17.0	19.0	17.0	16.0	17.7	20.0	18.3	18.0
	Ct.	238.6	235.2	243.4	239.2	238.6	245.8	245.8	235.0	239.5	
BD	Str.	16.8	19.9	17.0	18.9	17.0	18.9	17.5	17.0	17.0	17.5
	Ct.	245.8	235.0	243.6	234.8	240.0	234.0	240.0	234.0	238.4	
H 23	Str.	15.5	16.2	14.7	16.0	15.0	15.0	16.0	14.3	15.3	15.5
	Ct.	235.2	245.8	241.8	240.8	244.6	244.6	236.0	239.0	243.2	
V 135	Str.	17.5	16.0	18.0	17.7	17.7	17.0	17.7	15.5	17.1	17.6
	Ct.	249.4	247.0	242.2	242.2	254.2	250.4	250.0	241.0	247.5	

SPINNING TESTS ON ST. VINCENT 1923 CROP (NINE SAMPLES):
TESTING REPORT

West Indian, Commercial Mixing (Mynshull Mills), control sample to St. Vincent 1923 crop, gave results as follows:

Preparation. — Scutcher loss per cent. Card loss per cent. Comber loss per cent.

Testing (Two-lea Tests) :

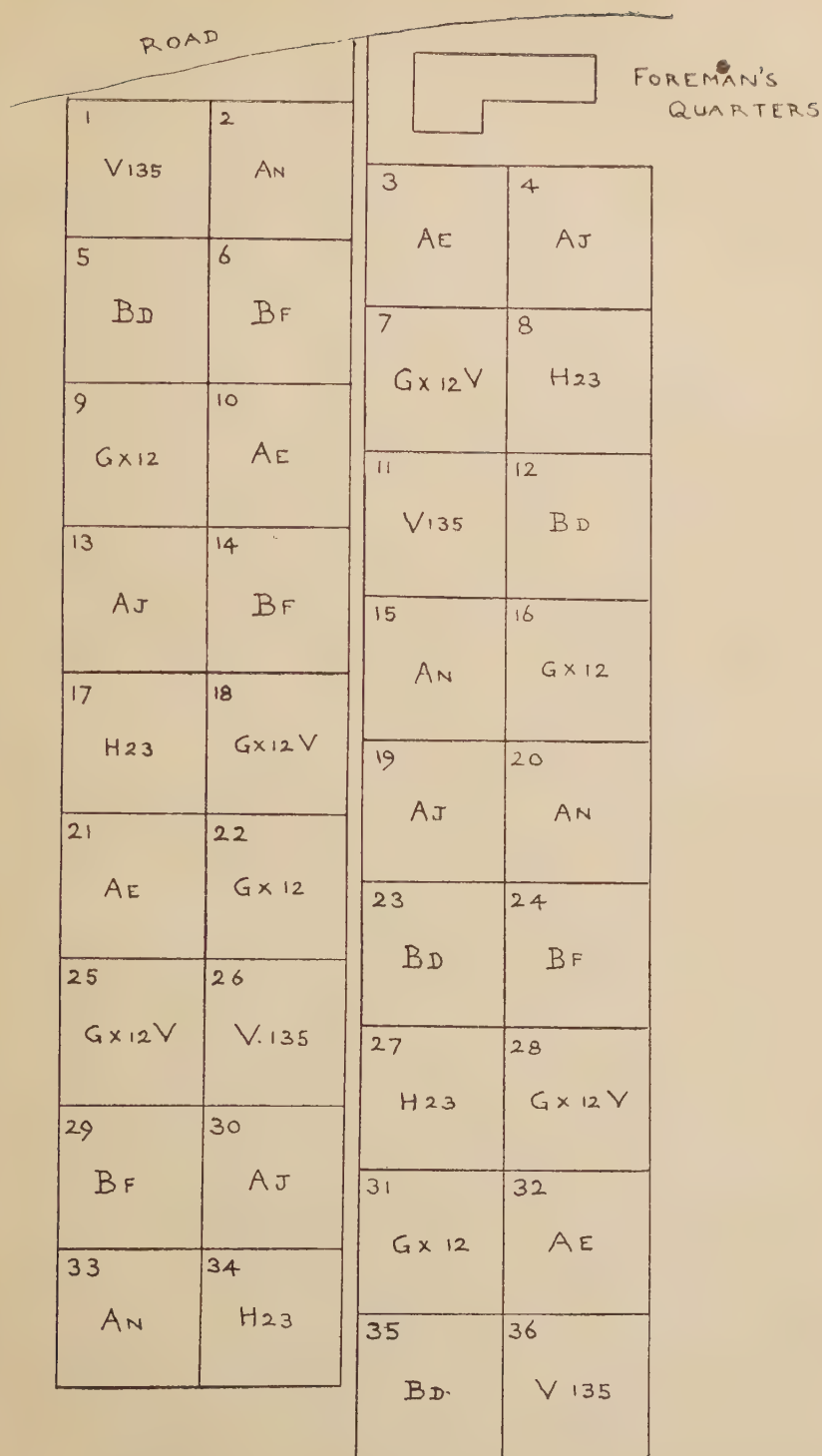
	<i>Mean.</i>											
Str. ..	14.0	15.0	15.0	13.5	13.5	13.5	13.5	14.0	13.5	12.5	13.8	
Ct. ..	238.0	245.6	244.4	250.8	240.0	246.8	250.8	250.8	244.4	249.6	246.1	

Mean strength corrected to nominal 240's counts by the correlation method—15.6 lbs.

HAIR TESTS.

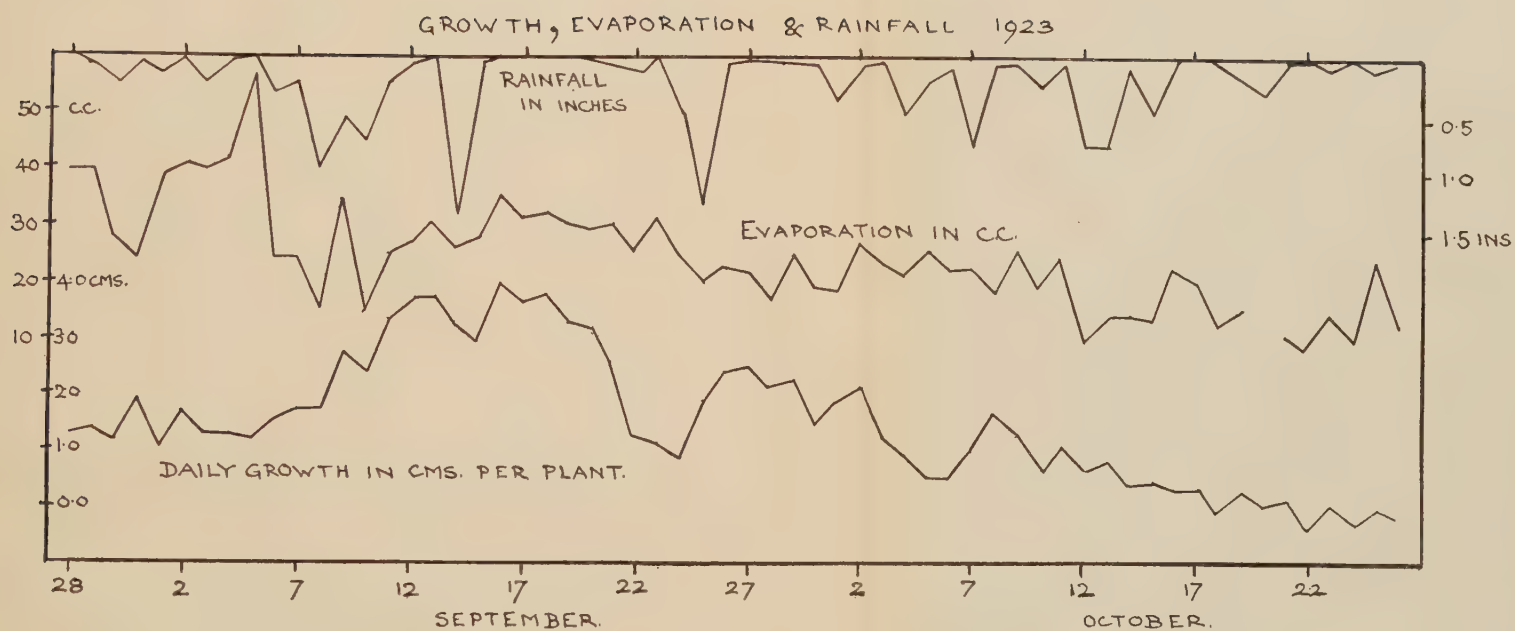
<i>Sample.</i>			<i>Weight.</i> (<i>Mg./Cm.</i>)	<i>Strength.</i> (<i>Gms.</i>)	<i>Strength per Weight</i> <i>of 0.001 Mg.</i>
V 135=1	..	..	0.00111	4.30	3.95
AN=2	..	..	0.00119	4.51	3.79
AE=3	..	..	0.00116	4.31	3.71
AJ=4	..	..	0.00105	4.28	4.07
BD=5	..	..	0.00104	3.33	3.20
BF=6	..	..	0.00105	3.87	3.68
GX 12V=7	..	..	0.00105	3.75	3.57
H 23=8	..	..	0.00128	3.94	3.08
GX 12=9	..	..	0.00101	3.85	3.81
<i>Control Sample :</i>					
West Indian	..		0.00115	3.20	2.78

FIGURE 1.



PLAN OF THE PLOTS

FIGURE II.



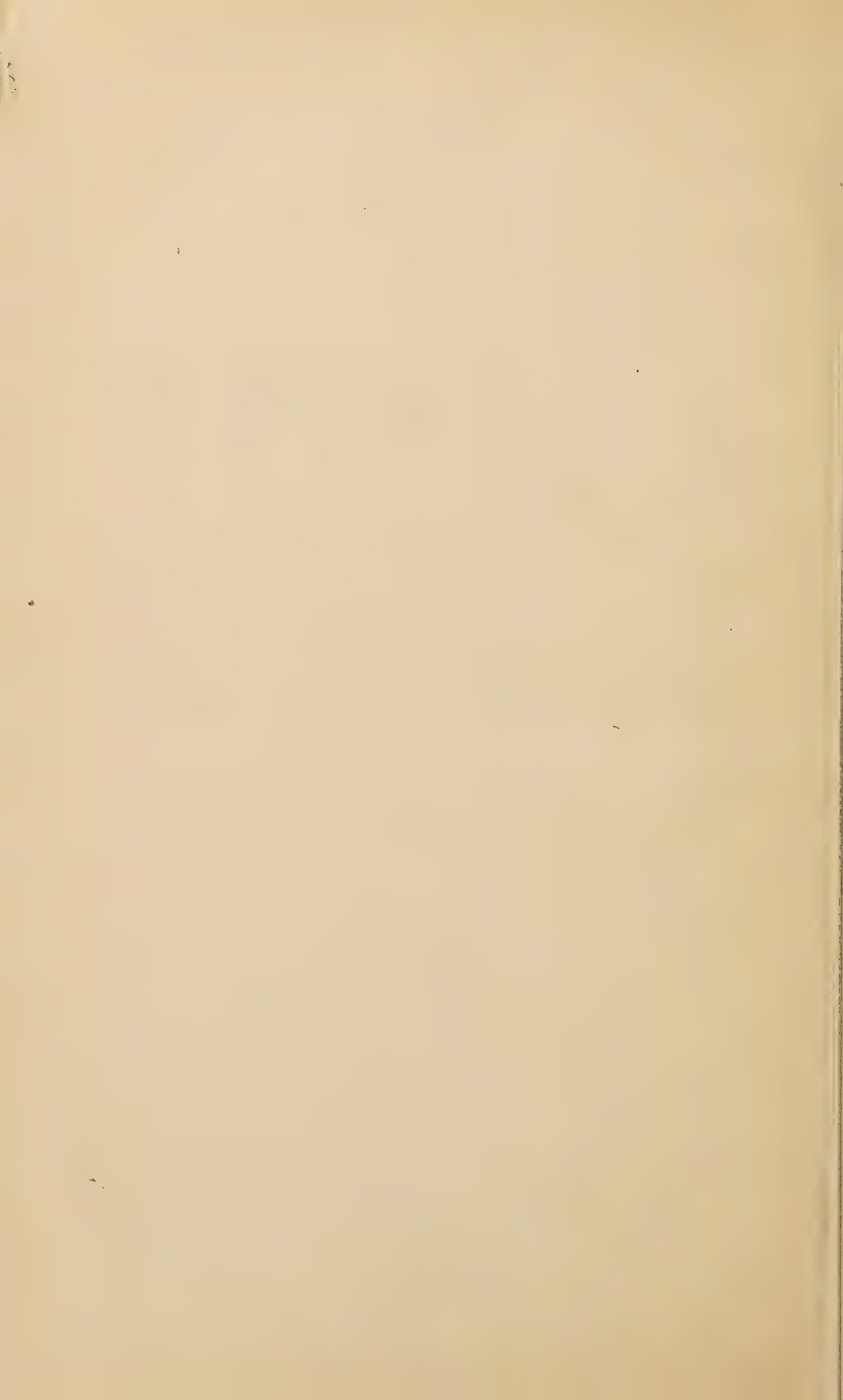


FIGURE III.

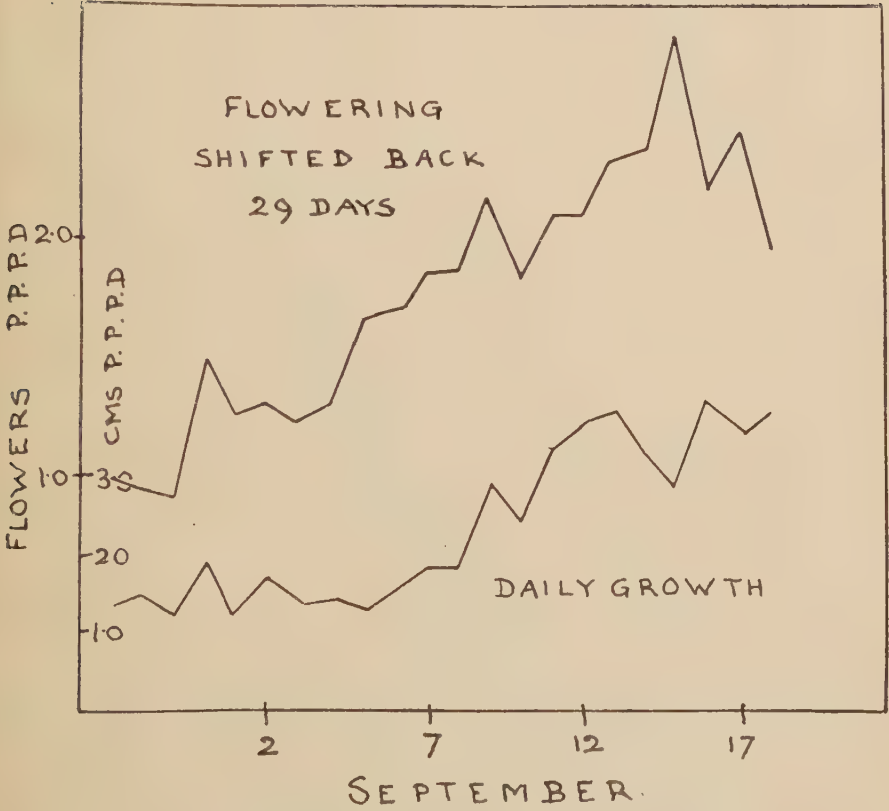
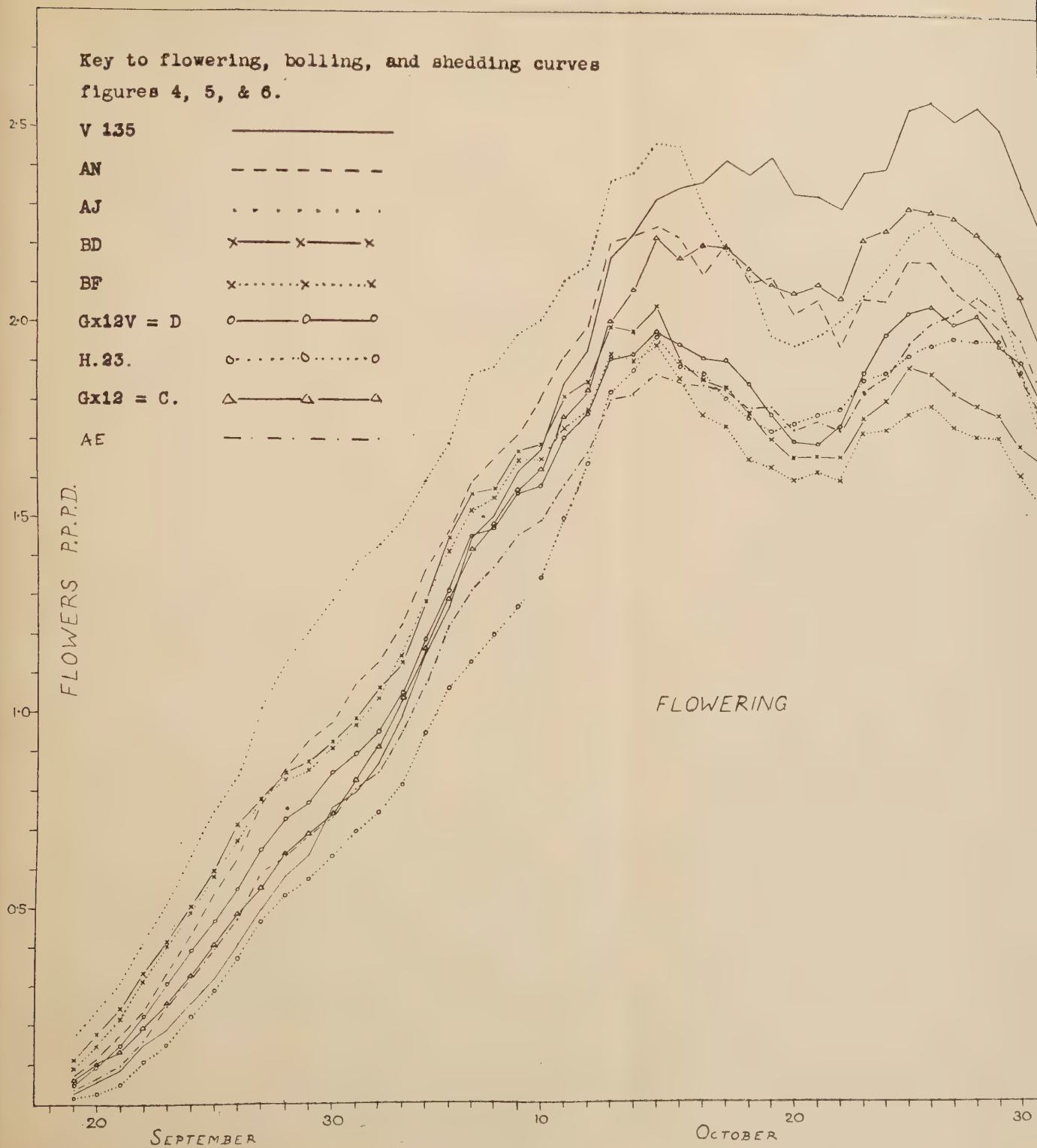




FIGURE IV.



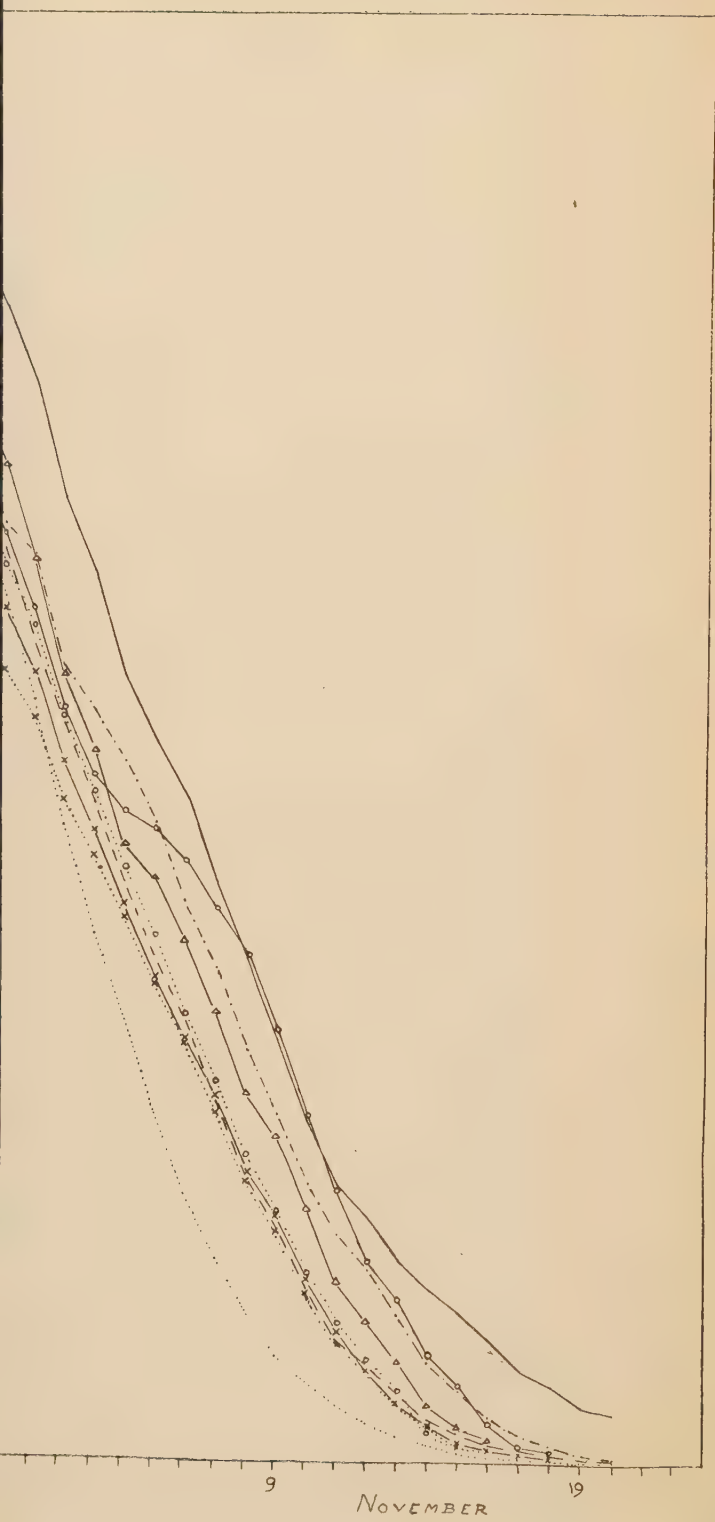


FIGURE V.

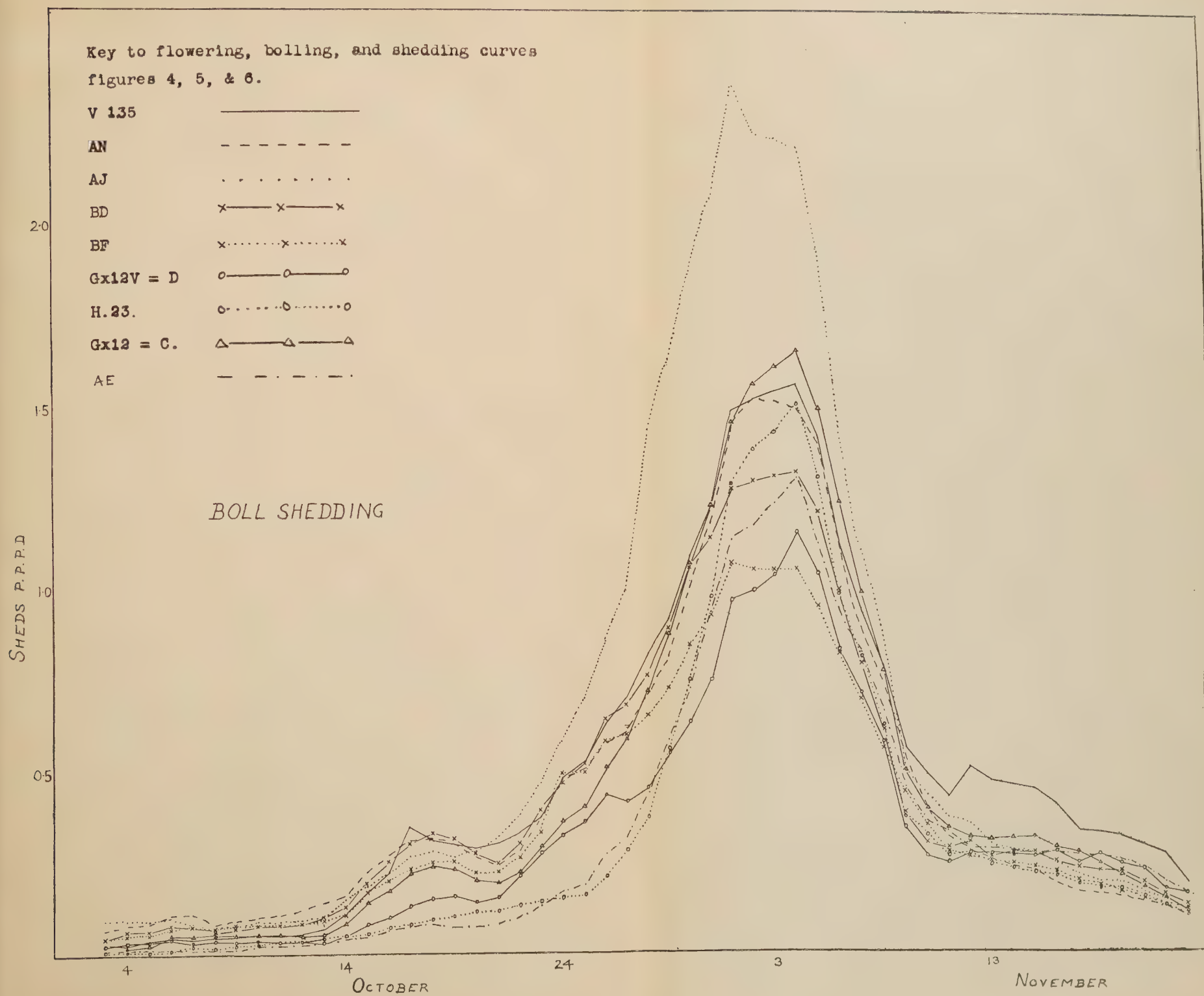
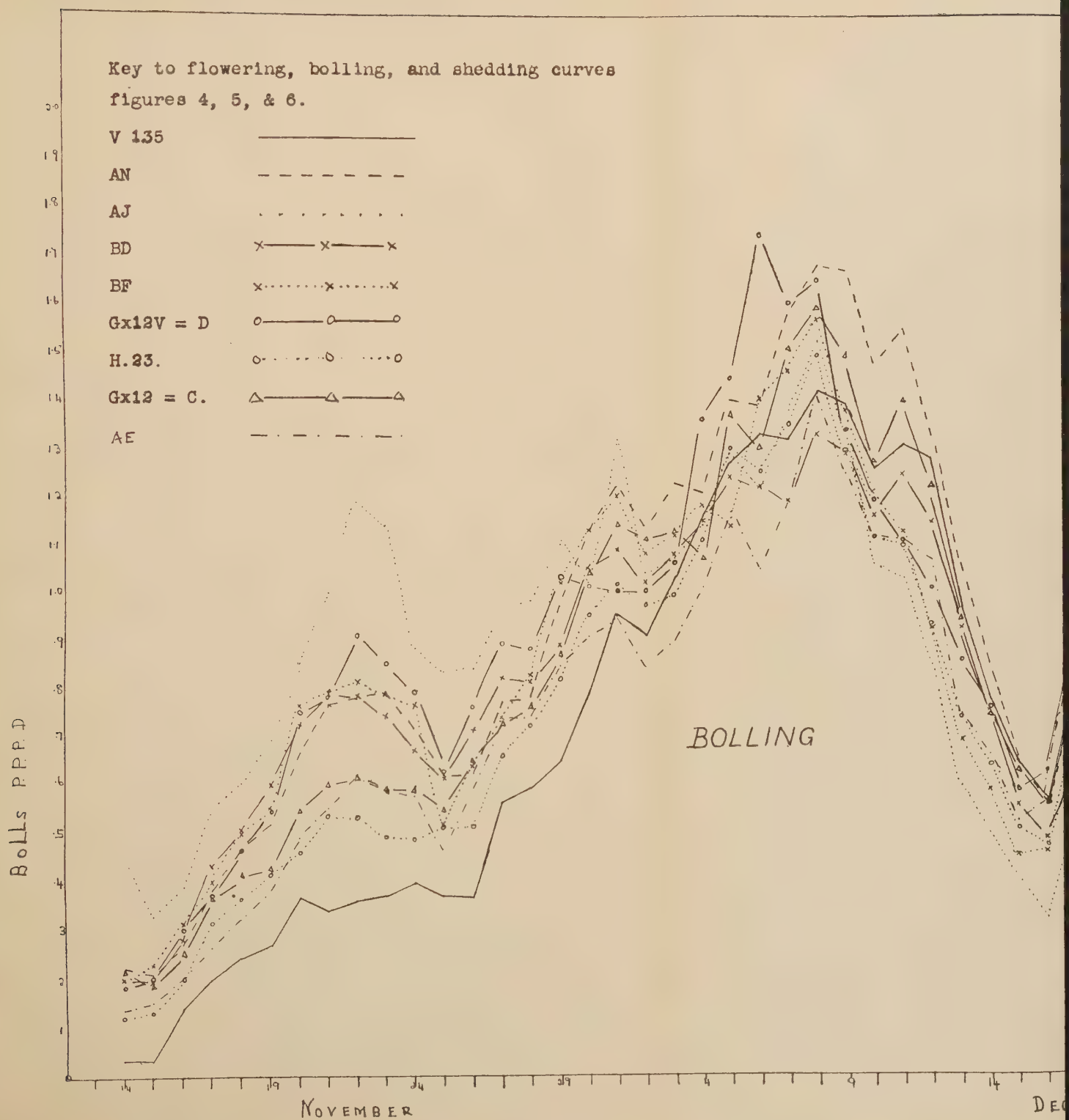




FIGURE VI.



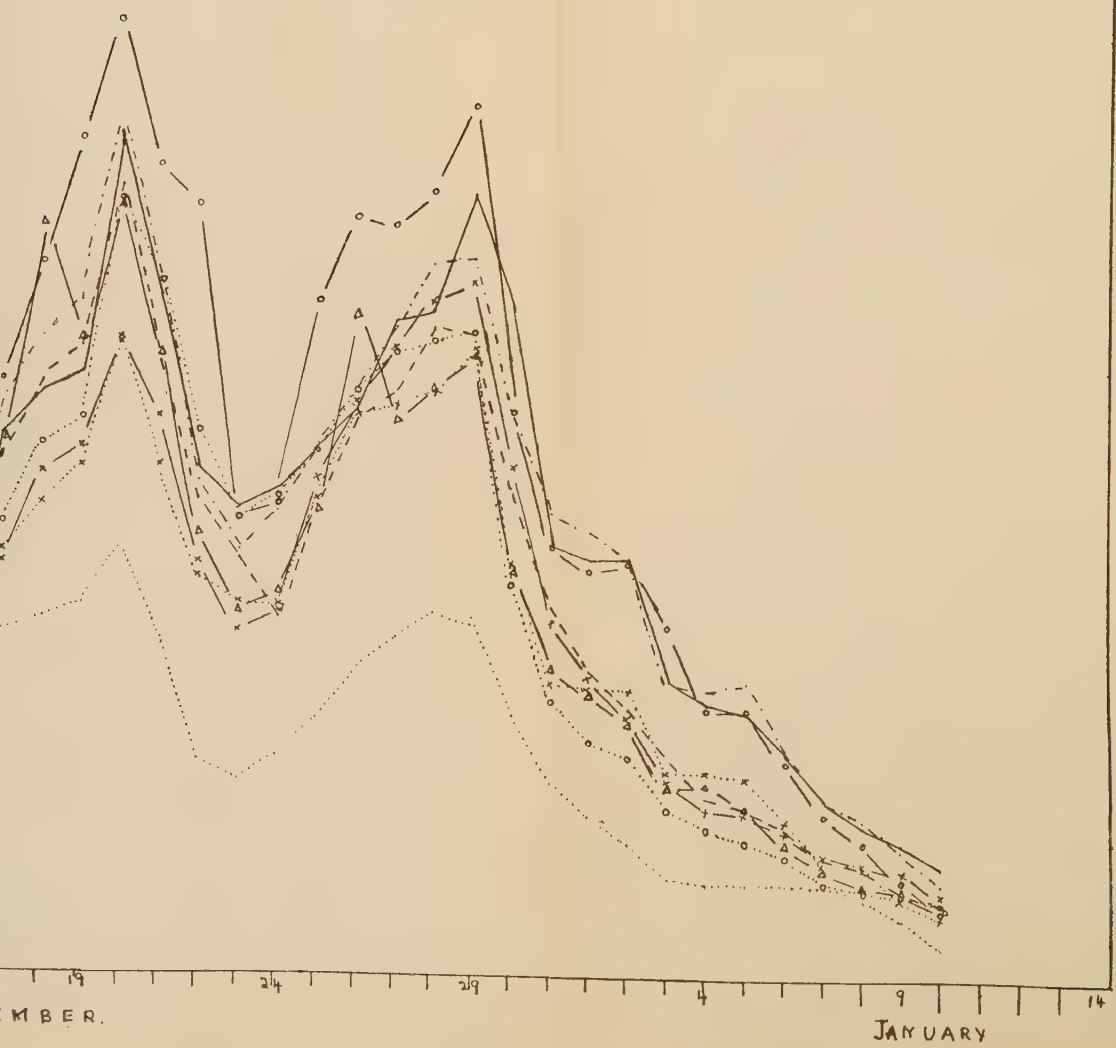
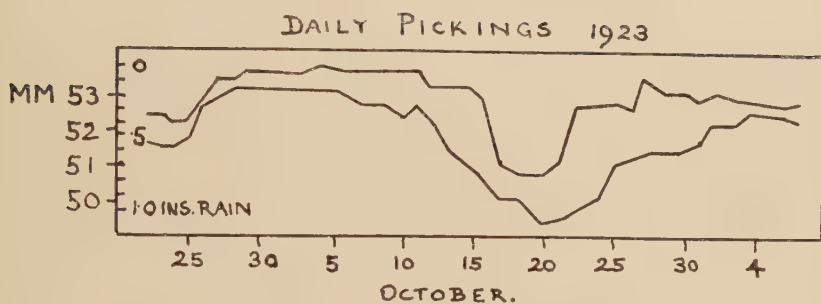


FIGURE VII.



EXPLANATION.

1. Dates are for flowering.
2. Lower line, maximum lint length in millimetres from the bolls from dated flowers, smoothed by overlapping five-day means.
3. Rainfall smoothed by the same averaging method and shifted forward nineteen days to show the correlation between rainfall and subsequent length of lint.

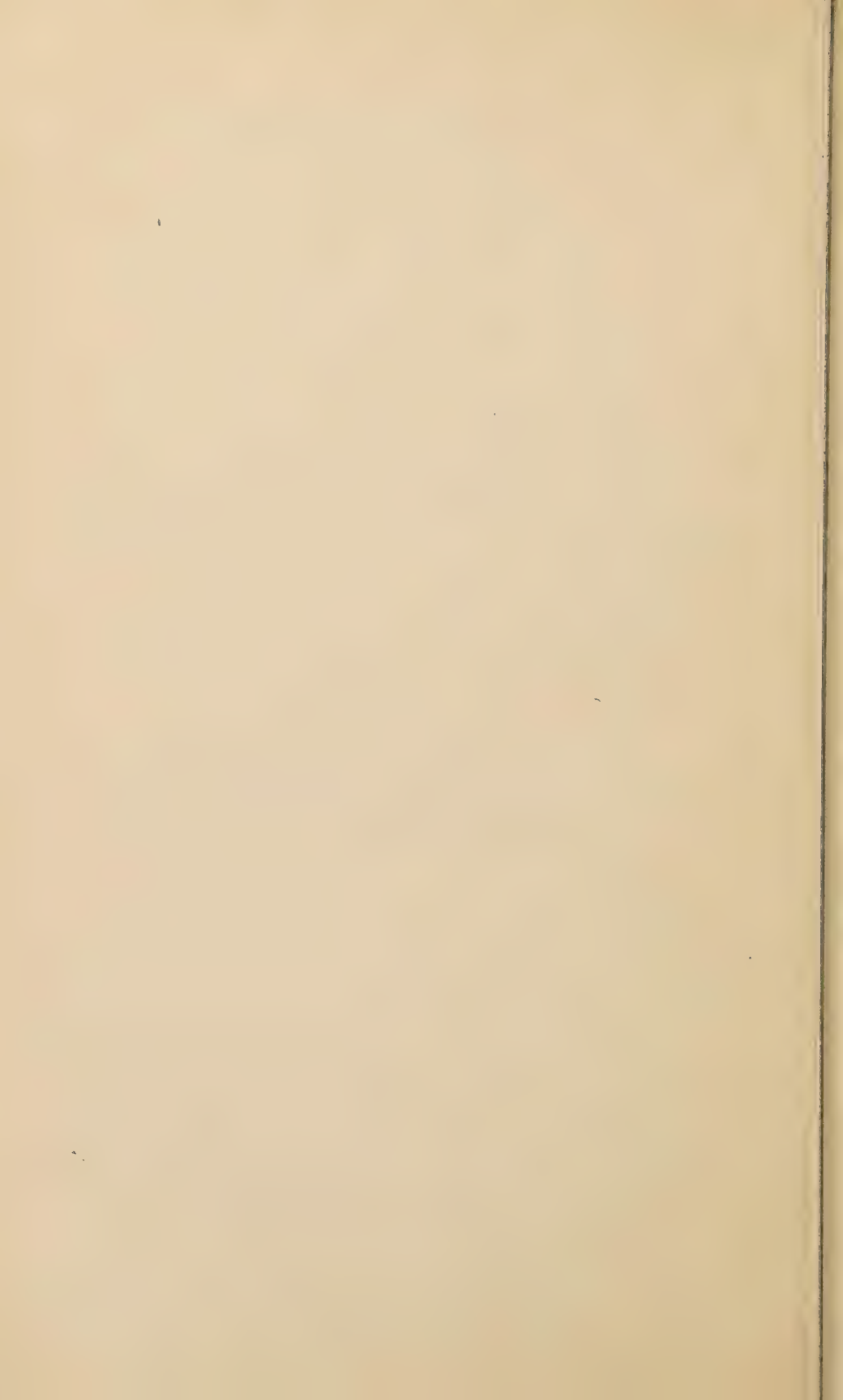
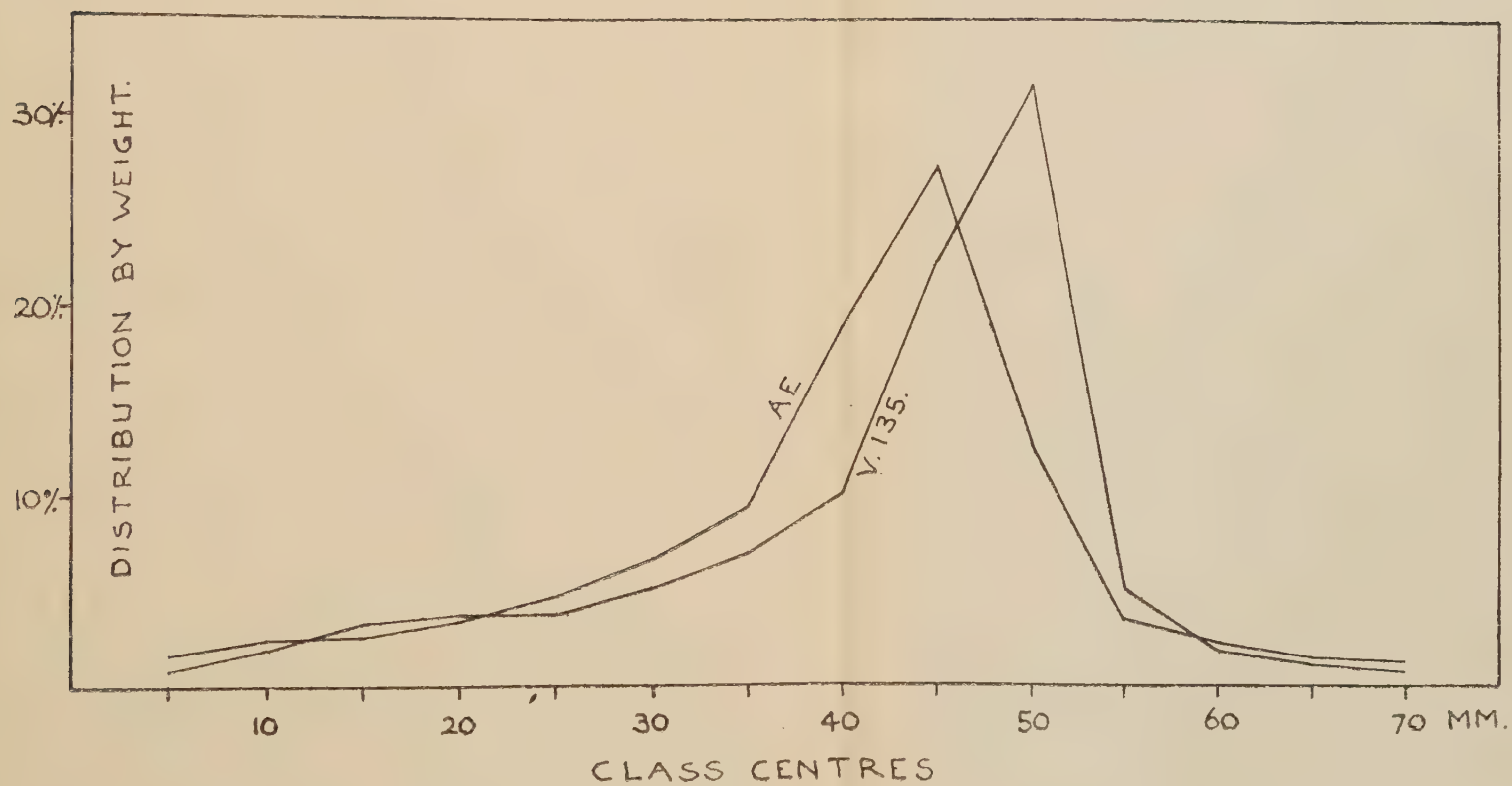


FIGURE VIII.



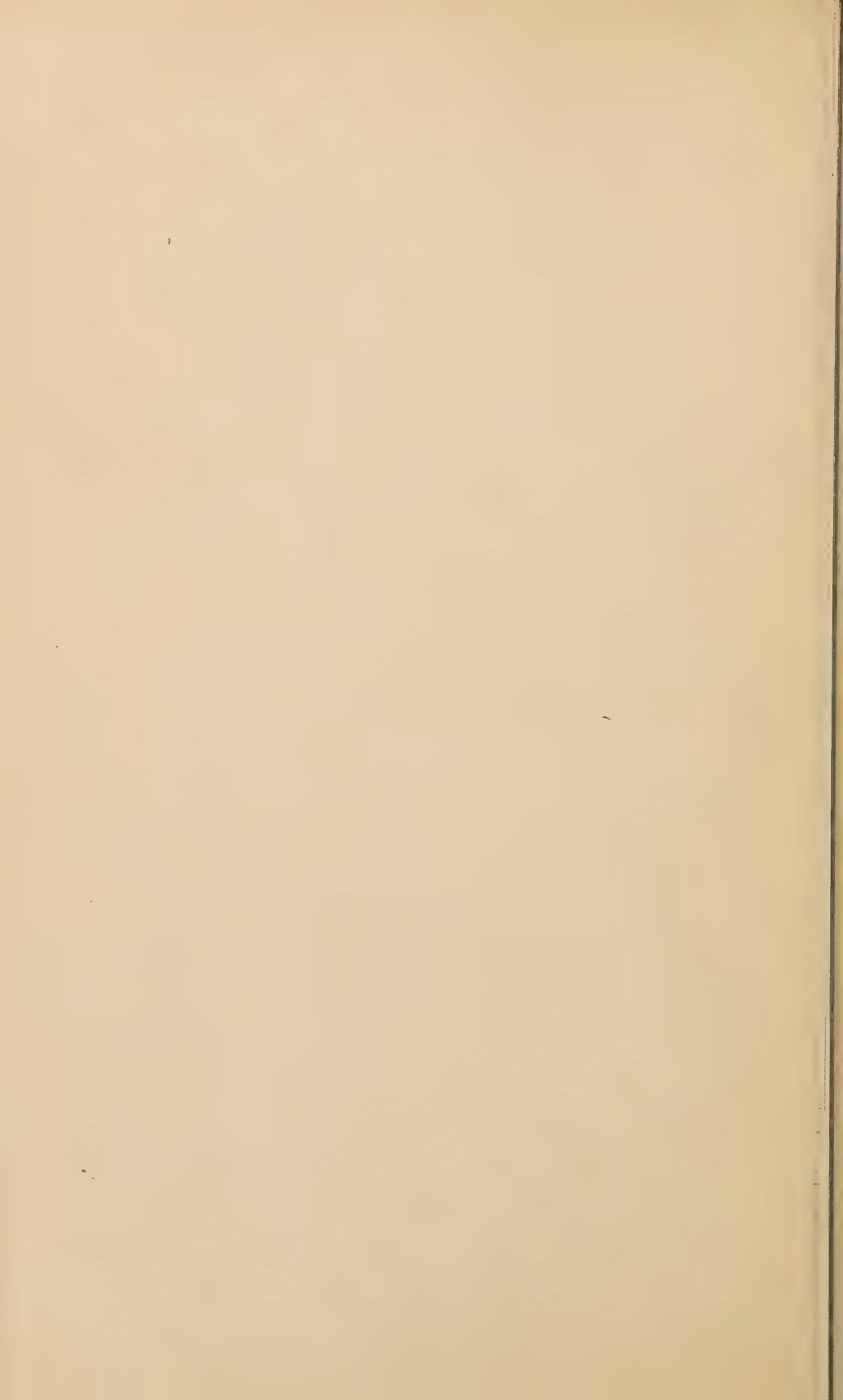
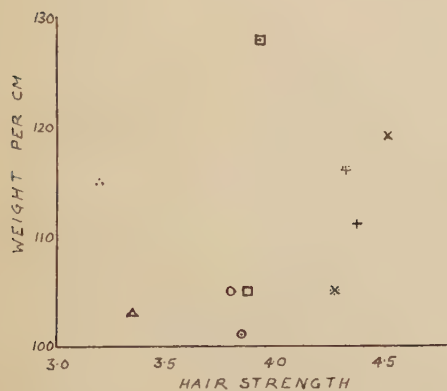
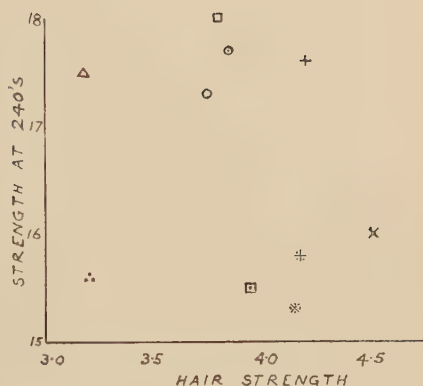
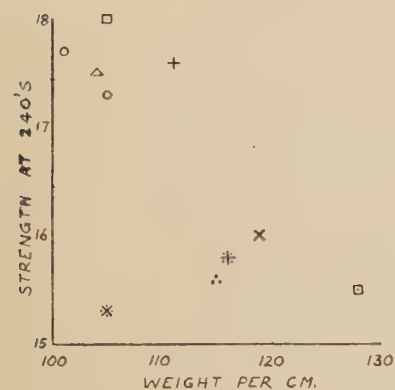


FIGURE IX.



V.135 +
AN x
AE #
AJ *
BD Δ
BF □
Gx12 V ○
H23 ◻
Gx12 ◊
CONTROL ∴

CORRELATION DIAGRAMS.

